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DEPARTMENTS

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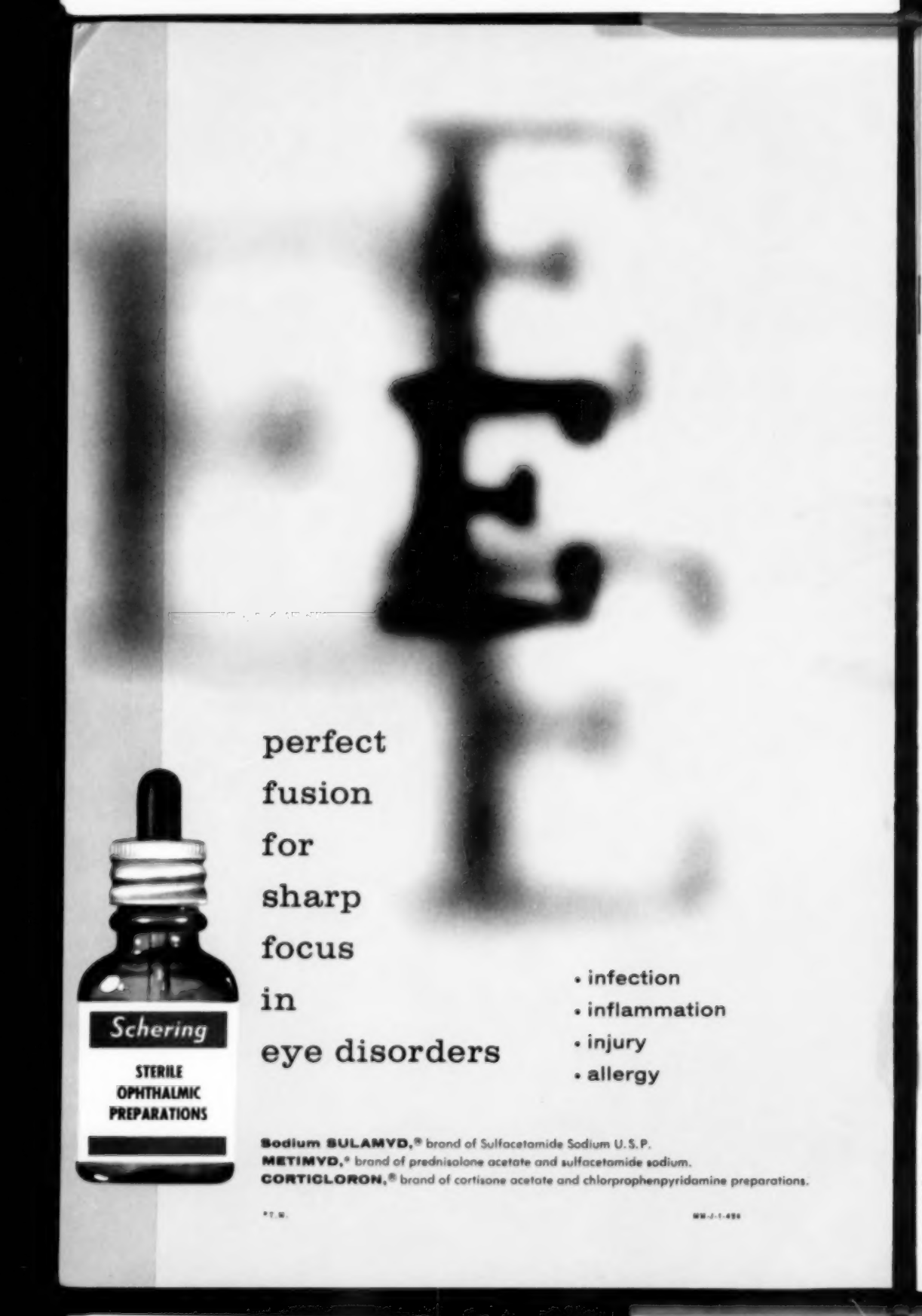
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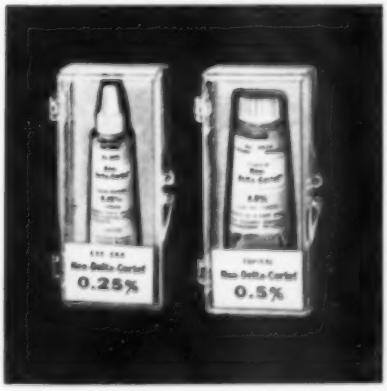

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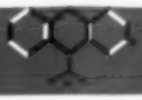

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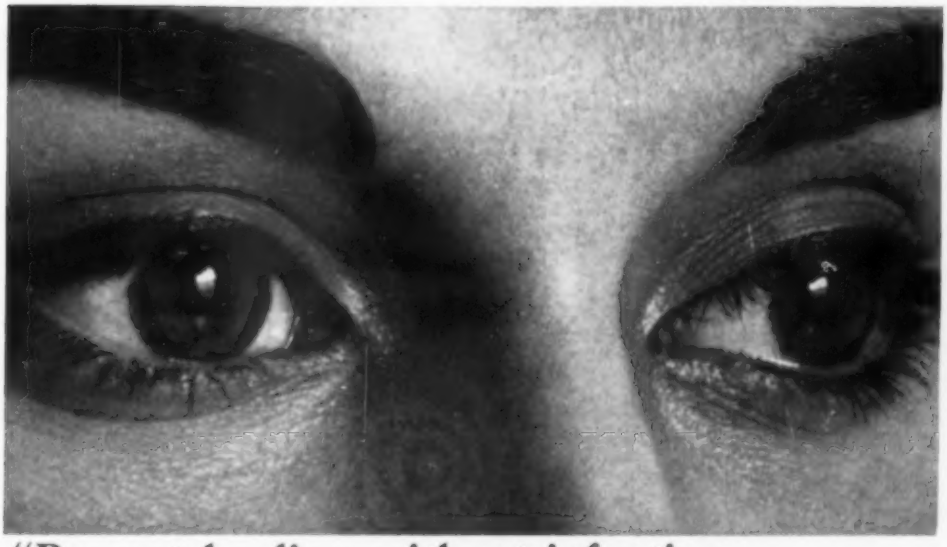

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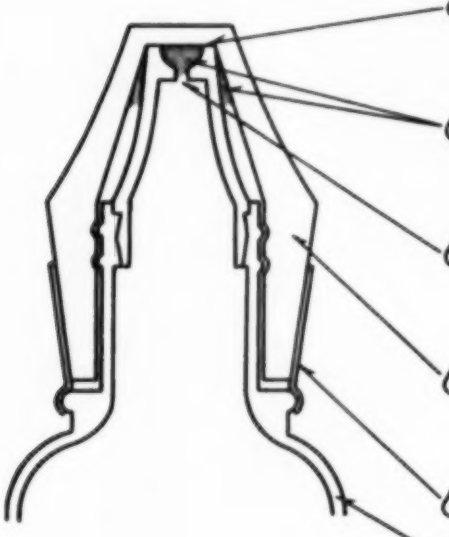

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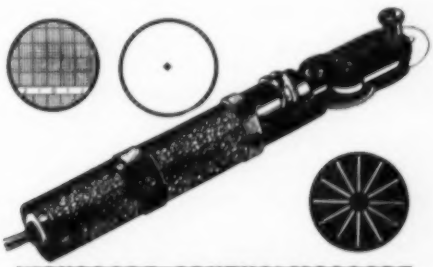

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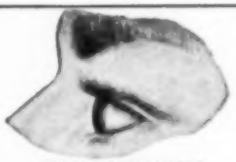

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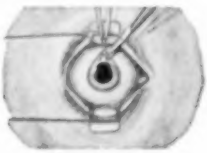

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AMERICAN JOURNAL OF OPHTHALMOLOGY

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EPITHELIAL INVASION OF THE ANTERIOR CHAMBER*

A. EDWARD MAUMENEE, M.D.
Baltimore, Maryland
AND
C. RICHARD SHANNON, M.D.
San Francisco, California

Invasion of the anterior chamber by epithelium is a comparatively rare occurrence, and the individual ophthalmologist in choosing his therapeutic approach is forced to rely on the few cases reported in the literature[1-12] rather than on personal therapeutic experience. It is difficult to evaluate the various suggested methods of treatment for the reason that it often is not clear what type of epithelial invasion is under discussion. In 1937, Perera clarified the problem by suggesting that epithelial invasion of the anterior chamber be classified under the headings of epithelial pearls, epithelial cysts, and epithelial downgrowths.[5]

It is the primary purpose of this report to describe the clinical course and treatment of epithelial cysts of the anterior chamber. The material on which this report is based is 11 cases treated or observed by various members of the staff of the Stanford University Hospital. Epithelial cysts must be sharply differentiated from both the epithelial pearl tumors and epithelial downgrowths. The clinical pictures and therapy of the three conditions are as follows:

A. EPITHELIAL PEARL TUMORS OF THE IRIS

Epithelial pearl tumors of the iris are extremely rare lesions, only one such case having been observed in the Stanford University Hospital during the past seven years.

The various cases reported in the literature indicate that these cysts result from the implantation of a hair follicle or a piece of skin into the anterior chamber at the time of a perforating injury. Clinically, these cysts appear as solid pearly tumors or opaque white cysts on the surface of the iris and are not connected with the wound of entry into the anterior chamber (fig. 1). The mass grows slowly and often does not exceed two to three mm. in diameter, although in an occasional case it may fill most of the anterior chamber and extend into the posterior chamber.[3, 8, 11] There may be a minimal inflammatory reaction or a mild iridocyclitis. If the tumor increases in size or if it produces an iridocyclitis, it should be removed in toto by a complete iridectomy in the area of the mass. If the entire tumor is removed, the prognosis is good, but if only part of the lesion is excised the tumor usually recurs, secondary glaucoma often develops, and the eye is eventually lost.

Histologically, the tumors are encapsulated and consist of layers of stratified or cuboidal epithelium. The central core is composed of either concentric layers of keratinized cells or a necrotic, amorphous mass of keratinized epithelium and cholesterol crystals. Occasionally hair follicles or foreign bodies are found in the tumor.

* From the Division of Ophthalmology, Department of Surgery, Stanford University School of Medicine, San Francisco, California. Presented before the 38th annual meeting of the Pacific Coast Oto-Ophthalmological Society.

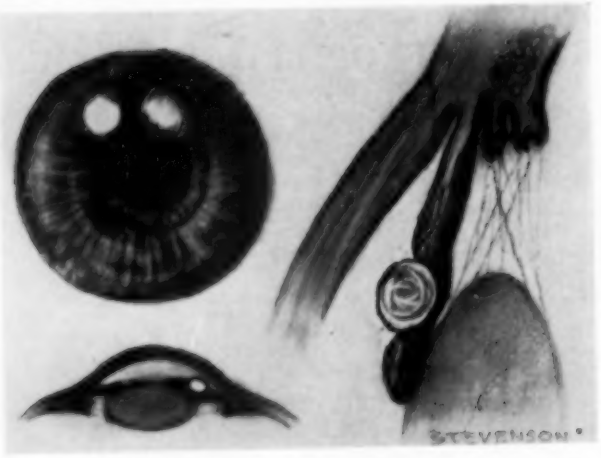

Fig. 1 (Maumenee and Shannon). Drawing of epithelial pearl tumor or cyst of iris.

B. Epithelization of the anterior chamber or epithelial downgrowth

The incidence of epithelial downgrowth into the anterior chamber following perforating injuries or surgical procedures is impossible to determine from reports in the literature because of the confusion between epithelial downgrowths and epithelial cysts.

Terry[6] reported that in 45,500 cases of perforating wounds of the anterior chamber, 28 eyes were enucleated and sent to the pathology laboratory on account of epithelial invasion of the anterior or posterior chamber. This is an incidence of 0.06 percent of the cases. Fifteen of these 28 cases had some type of operation on the lens.

Theobald and Haas[2] similarly reported an incidence of 0.11 percent of histologically proven epithelial invasion of the anterior chamber in 8,062 cataract extractions. These figures only reflect the incidence of epithelial invasion in posttraumatic or postoperative eyes sent to the pathologic laboratories. A clearer picture of the importance of epithelial invasion is obtained from the fact that in 75 eyes enucleated following cataract extraction in the Illinois Eye and Ear Infirmary from the period of 1934 through 1945, 14 or 18 percent of these eyes showed epithelial invasion of the anterior chamber.

Perera[5] similarly reported that of 35 eyes enucleated after cataract extraction, and received in the pathology department of the Institute of Ophthalmology of the Presbyterian Hospital between 1929 and 1938, 11 percent showed epithelium invasion of the anterior chamber.

The clinical and histologic appearance of epithelial downgrowth or epithelization of the anterior chamber has been clearly described by Calhoun.[1] The lesion occurs most frequently following poorly performed cataract extractions in which the anterior chamber has not been properly closed and the anterior chamber has remained flat or the eye soft for several days or weeks after extraction. When the epithelium invades the anterior chamber, a thin translucent membrane can be detected on the posterior surface of the cornea when the eye is carefully examined with the slitlamp and biomicroscope.

An important finding in these eyes is a fine gray line just at the lower border of this membrane. The cornea overlying the downgrowth is occasionally slightly edematous and newly formed vessels may or may not be present in the deep layers of the stroma. Epithelium may also cover the surface of the iris underlying the area of corneal involvement. In such regions there is a

Fig. 2 (Maumenee and Shannon). Drawing of epithelial downgrowth in the anterior chamber.

slight loss of normal iris markings, and careful examination with high magnification of the biomicroscope reveals a thin film on the anterior surface of the iris (fig. 2). In other instances, the iris may be drawn up toward the incision of the cataract extraction. If a total iridectomy has been done, there may be a condensation on the face of the vitreous in the involved area. A low-grade iridocyclitis may or may not accompany the epithelization of the anterior chamber.

The epithelium grows more rapidly over the iris and trabecula than it does on the back of the cornea and, therefore, the progress of corneal involvement cannot be used as an indication of arrest or retardation of epithelial invasion. If the lesion is allowed to progress over a long period of time, an intractable secondary glaucoma will develop from occlusion of the trabecula by the new epithelium or from an accompanying iridocyclitis.

The clinical diagnosis of epithelial downgrowth of the anterior chamber is often extremely difficult to make. This is attested to by the fact that in the majority of eyes in which this lesion is observed histologically, the condition has not been recognized prior to enucleation.

A number of other lesions are often misdiagnosed as epithelial downgrowth. Some of these are (1) a very shelving corneal section for cataract extraction, (2) vitreous in contact with the posterior surface of the cornea following a wide iridectomy for cataract extraction, (3) invasion of the anterior chamber by connective tissue and blood vessels, (4) a peeling off of Descemet's membrane from the posterior surface of the cornea above, (5) a glassy membrane on the posterior surface of the cornea and the anterior surface of the iris. This last mentioned condition is the most difficult lesion to differentiate from epithelization of the anterior chamber. These glassy membranes usually occur in eyes which have undergone a prolonged iridocyclitis. The membrane consists of a reduplication or a newly formed Descemet's membrane on the posterior surface of the cornea and its extension from above over the anterior surface of the iris. In all of the other conditions, the anterior surface of the iris is either not involved or only slightly involved in the process. In detachment of Descemet's membrane it may be observed curling inward at its inferior edge. This should not be confused with the gray line due to a piling up of epithelial cells at the lower edge of a downgrowth.

At the present time the usual accepted

Fig. 3 (Maumenee and Shannon). Drawing of epithelial cyst of the anterior chamber.

treatment for epithelization of the anterior chamber is irradiation therapy. Reports of results of treatment, however, are equivocal. Even in the most favorable series reported, only 50 percent successes have been reported.[1, 7, 13] Also, while some authors report cures of epithelial downgrowth from as little as 700 r, others report that the downgrowth has not been stopped with as much as 2,400 r.

This high degree of variability may be the result of inadequate criteria as to what is to be considered a cure. It would seem that several factors should be considered:

First, it should be definitely established by biopsy that the lesion treated is an epithelial downgrowth.

Second, it should be remembered that epithelial downgrowth on the posterior surface of the cornea seldom covers more than the upper half. If a lesion is "arrested" by Roentgen therapy at the half-way mark, it cannot be considered a cure.

Finally, the patient should be followed for at least one year before an attempt is made to evaluate the treatment used.

Histologic examination of the enucleated eye containing epithelial downgrowth shows stratified squamous epithelium of the conjunctival or corneal type extending down the posterior surface of the cornea, replacing the endothelium. The layer of epithelium may be one cell or several cells in thickness but, at the margin of the lesion, there is usually a piling up of the cells, which accounts for the gray line seen clinically with the slitlamp. The lesion also extends over the trabeculae and down on the anterior surface of the iris. Occasional goblet cells are found in the epithelial surface on the iris. The basal columnar or cuboidal type of cells is usually present on the corneal or iris side of the downgrowth and the squamous type of cells is present on the aqueous side of the lesion.

C. Posttraumatic or Epithelial Cysts of the Anterior Chamber

The incidence of cyst formation in the anterior chamber cannot be accurately determined from the literature due to its confusion with epithelial downgrowth. However, it is probable that epithelial cysts occur more frequently after perforating injuries and cataract extractions than do epithelial downgrowths.

Epithelial cysts of the anterior chamber are usually easy to diagnose. They appear characteristically as translucent or grayish cysts which are connected, at least at one point, with the corneal wound or area of perforation into the anterior chamber (fig.

3). Occasionally, a cyst may invade the posterior chamber through a peripheral iridotomy or it may actually erode the iris. If this occurs, the iris overlying the cyst becomes thinned and the cyst appears to arise from the iris stroma. On other occasions when the epithelium invades the posterior chamber, a light sprinkling of pigment may cover its surface.

The rate of progress of these cysts is extremely variable. An epithelial cyst may lie dormant for years before it makes its appearance in the anterior chamber, or it may grow to considerable size and then remain stationary without causing further damage to the eye. Some cysts cause chronic iridocyclitis while others may be large enough to produce an intractable secondary glaucoma.

Only a few conditions closely simulate epithelial cysts of the anterior chamber. Differentiation must be made from neuroepithelial cysts of the pigment epithelium of the iris. These usually contain considerably more pigment in their walls and do not cause so great an atrophy of the overlying stroma of the iris. Parasitic cysts of the anterior chamber may enter the differential diagnosis, but these lesions are so rare in this country that they do not constitute a real diagnostic problem. Spontaneous cysts of the iris or congenital epithelial implantation cysts have been reported, but it is questionable if lesions of this type actually occur. Most reports of iris stromal cysts antedate the slitlamp and biomicroscope and it is quite probable they may have been secondary to a small perforating injury of the cornea which had been overlooked.

Just why an epithelial cyst occurs in one case and an epithelial downgrowth in another is not known. Delayed closure of the wound, hypotony, and fistulization predispose to both conditions. It has been postulated that epithelial cysts arise from a bud of epithelium which has been pinched off into the anterior chamber, and that epithelial downgrowths occur by a migration of sheets of epithelium along the edges of a wound which did not close properly. Neither of these suggestions has been substantiated by adequate clinical or experimental observation.

Numerous forms of treatment have been suggested for epithelial cysts. Among these are repeated tappings of the cyst, coagulation with electrodiathermy or electrolysis either before or after the cyst has been evacuated, irrigation of the cyst with various corrosive solutions, irrigation with radioactive isotopes, irradiation of the cyst, partial surgical removal or attempted complete surgical removal of the cyst.[14-21] Each of these forms of treatment has had its advocates, and an occasional successful result has been reported with each type of treatment. However, usually only one or two cases have been reported by each author and the follow-up period has been limited to several months only.

Verhoeff[14] pointed out in 1939 that subtotal removal of cysts of the anterior chamber may result in a permanent cure. He reported three cases in which there was no apparent recurrence of the cyst following subtotal removal and stated that it was difficult for him to visualize how every epithelial cell could be removed on attempted extirpation.

Report of cases of epithelial cysts

In 10 of the cases here reported subtotal removal or attempted total removal of epithelial cysts from the anterior chamber has been performed at the Stanford University Hospital (table 1). In nine of these cases, the clinical impression of epithelial cyst has been confirmed by histologic examination. The last case (11) has not yet been operated upon. The greater number of these patients were first seen some time after the original perforating injury or operation, having come to the hospital because of the late development of a cyst in the anterior chamber. Therefore, in these cases there is rarely a detailed or accurate history of the initial postoperative or posttraumatic course.

TABLE 1

FINDINGS IN REPORTED CASES*

Case		Age (yr.)	Type of Operation	Complications	Onset of Cyst (history)	Size	Presenting Problem
1	D. H.	7	Perforating injury	None in history	10 yr.	1/2 AC	Loss of visual acuity, photophobia
2	B. B.	5	Perforating injury	None in history	6 mo.	1/8 AC	None
3	R. H.	22	Perforating injury	None in history	3 yr.	1/4 AC	"Growth" in anterior chamber
4	A. M.	67	Cataract extraction	None in history	8 mo.	1/3 AC	Loss of visual acuity (iritis)
5	M. L.	47	Cataract extraction	None in history	5 yr.	1/3 AC	Loss of visual acuity (glaucoma)
6	M. B.	81	Cataract extraction	None in history	1+ yr.	1/3 AC	Pain (glaucoma)
7	R. C.	3	Cataract extraction	None in history	1 yr.	1/3 AC	Mild pain (iritis and glaucoma)
8	A. R.	55	Cataract extraction	None in history	6 yr.	1/2 AC	Loss of visual acuity
9	R. S.	62	Cataract extraction	None in history	5 mo.	1/6 AC	None
10	D. B.	30	Cataract extraction	None in history	6 mo.	1/10 AC	Loss of visual acuity

Case	Corneal Curettement	Previous Treatment	Final Condition of Cornea	Follow-up	Glaucoma	Vision		Cause of Loss of Vision
						Before	After	
1	Yes	None	Mild edema	4 1/2 yr.	None	20/70	20/70	
2	Yes	None	Clear	4 yr.	None	20/20	20/20	
3	No	None	Clear	1 mo.	None	20/30	20/30	
4	Yes	None	Severe edema	3 1/2 yr.	None	20/70	8/200	Edema of cornea
5	No	Partial excision	Mild edema	6 yr.	Controlled	20/100	20/70	
6	No	X-ray	Clear	1 yr.	Controlled	20/30	20/30	
7	No	Cautery	Opaque	4 yr.	Uncontrolled	Not det.	L.P.	Corneal dystrophy
8	Yes	None	Clear	1 3/4 yr.	None	20/40	20/80	Capsule opacity
9	Yes	None	Clear	1 1/2 yr.	None	20/20	20/20	
10	Yes	Aspiration & diathermy (twice)	Clear	3/4 yr.	None	20/300	H.M.-15′	Chronic uveitis

* There was no recurrence of the cyst in any instance.

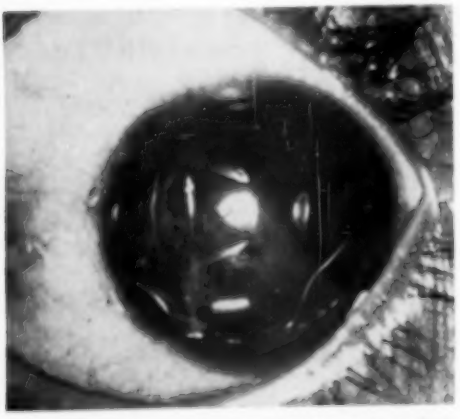

Fig. 4 (Maumenee and Shannon). *Case 1.* Epithelial cyst of the anterior chamber after perforating injury.

CASE 1

D. H., a 44-year old Negress, suffered a perforating scissors injury of the left eye at the age of seven years. In 1929, when she was 17 years old, a friend noted a white spot in her left eye. Twenty years later, over a one-year period, there was a marked increase in the size of this spot and a mass appeared in the anterior chamber. This was accompanied by some loss of visual acuity. When first examined in 1949, the visual acuity in her left eye was 20/70 for distance and J14 for near. There was a grayish, translucent cyst which filled the lower nasal half of the anterior chamber and covered most of the pupillary area (fig. 4).

On September 20, 1949, the cyst was removed from the anterior chamber through an ab externo approach. The cyst was ruptured as the anterior chamber was entered. The posterior surface of the cornea was curetted and a large iridectomy was performed in the area where the epithelium was attached to the surface of the iris. The immediate postoperative course was uneventful. There was a

mild edema of the cornea in the area where the cyst had been present but the rest of the cornea remained clear.

The patient was last seen in March, 1955, at which time her visual acuity was 20/70. The intraocular pressure was normal and there was no evidence of recurrence of the cyst (fig. 5).

Microscopic examination of the tissue removed from the eye revealed distorted, degenerated iris tissue which was covered by surface epithelium.

CASE 2

B. B., a five-year-old boy, was struck in the left eye by an arrow in May, 1950. The cornea was lacerated and there was an iris prolapse. The iris prolapse was excised and the corneal laceration was closed on the day of injury. Four months later, an epithelial cyst was noted in the superior portion of the anterior chamber. This appeared to be connected with the area where the cornea had been lacerated. Two months later, the cyst filled one eighth of the anterior chamber and the patient was then operated upon. A large iridectomy was done above, and the posterior surface of the cornea was scraped with a sharp, small knife. Postoperatively, the cornea cleared. The lens remained clear. Visual acuity was 20/20.

He was last seen in August, 1954, four years postoperatively. Visual acuity in the left eye was still 20/20 and there was no evidence of recurrence of the cyst or increase in intraocular pressure.

Examination of the tissue removed from the anterior chamber revealed surface epithelium varying from one to four cells in thickness covering the anterior and, in some places, the posterior surface of the iris. Occasional lymphocytes and plasma cells infiltrated the iris stroma.

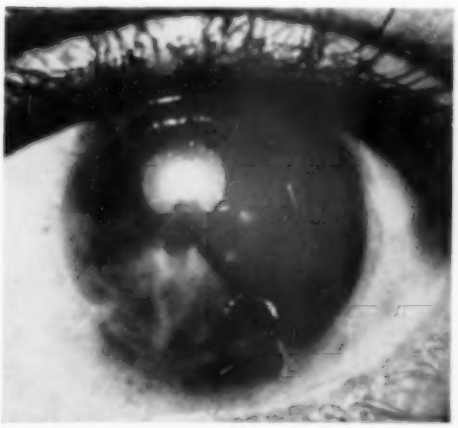

Fig. 5 (Maumenee and Shannon). *Case 1.* Same eye as in Figure 4, five and one-half years after surgical removal of epithelial cyst.

CASE 3

R. H., a 22-year-old sailor, was seen in consultation at the Stanford University Hospital in November, 1952, on one occasion only. He stated that a metal chip had been removed from his left eye in 1949. His lens had not been damaged and his visual acuity had been normal following the injury. In July, 1952, he noticed a mass in the anterior chamber of his left eye which increased in size. On examination it was found to measure approximately 4.0 by 5.0 mm. It touched the posterior surface of the cornea in the area of the penetrating scar. His tension was normal and his visual acuity was 20/30. There was an area of iridodialysis in the region of the cyst. The cyst was removed at the Oak Knoll Naval Hospital early in November, 1952, through an ab externo incision. A large iridectomy from the 2- to 5-o'clock positions was done in the left eye. The posterior surface of the cornea was not curetted.

His immediate postoperative course was uneventful and visual acuity was 20/30 at the end of December. The patient was returned to duty and killed in action in Korea so there is no further information on the result of the removal of the cyst from his anterior chamber.

Microscopic examination revealed iris tissue which was lined and partially eroded by stratified squamous epithelium in the form of a collapsed cyst.

CASE 4

A. M., a 64-year-old man, had an uncomplicated intracapsular cataract extraction on his right eye in August, 1950. No mention was made in the postoperative notes of delayed reformation or a fistula of the anterior chamber. The corrected visual acuity six weeks after operation was 20/20. He then developed a chronic iridocyclitis and his visual acuity dropped to 20/70 by April, 1951. An epithelial cyst of the anterior chamber was noted where one pillar of the iris was slightly included in the wound.

The patient was first seen at the Stanford University Hospital in December, 1951. At that time he had an epithelial cyst which was attached to the wound above and not only filled the anterior third of the chamber, but also appeared to invade the posterior chamber. The cyst contained three lobules (fig. 6). There was a chronic iridocyclitis of nongranulomatous type. Visual acuity was 20/400.

On December 19, 1951, the cyst was removed. A conjunctival flap was cut down from above, an ab externo incision was made into the anterior chamber in the area of the cyst, and the cyst was evacuated. The posterior surface of the cornea was curetted in the area of the cyst and a large iridectomy was done above. At the time of the iridectomy, a moderate amount of vitreous was lost. The postoperative course was relatively uneventful. The iritis subsided but edema persisted in the superior portion of his cornea. On February 12, 1952, his corrected visual acuity was 20/40 (fig. 7). On November 5, 1953, 23 months after removal of the cyst, visual

Fig. 6 (Maumenee and Shannon). *Case 4.* Multilobulated epithelial cyst of the anterior chamber following cataract extraction.

acuity could be corrected to 20/50, but there was a diffuse edema of the cornea above where the vitreous was adherent to the cornea (fig. 8).

During the next two years the cornea gradually became more edematous and by May 2, 1955, the edema had reached the lower portion of the cornea reducing the patient's visual acuity to 8/200.

His tension has remained normal and there has been no evidence of recurrence of the epithelial cyst or epithelium in the anterior chamber.

Histologic examination of the specimen revealed the iris to be slightly infiltrated with lymphocytes and plasma cells. The wall of the cyst was composed of stratified squamous epithelium, three to four cells in thickness (fig. 9).

CASE 5

M. L., a 47-year-old woman, underwent an uneventful intracapsular cataract extraction with a complete iridectomy above on the left eye in February, 1939. No corneoscleral sutures were used. The postoperative course was reported to be uneventful, and two months after operation her corrected visual acuity was 20/15. The patient stated that, in 1944, a doctor told her she had two cysts in her anterior chamber. In 1945, one of these cysts was increasing in size and was accordingly excised.

The patient was first seen at the Stanford University Hospital in 1949. On examination there was a grayish translucent cyst extending from the angle of the anterior chamber from the 12- to 2-o'clock positions and a second cyst "apparently in the iris stroma" at the 10- to 12-o'clock position. Both cysts encroached upon the pupillary area and filled the upper one third of the anterior chamber. Visual acuity was 20/100 and the intraocular pressure was recorded as 40 mm. Hg (Schiøtz). There was no evidence of iridocyclitis.

In February, 1949, an attempt was made to remove the cyst from the anterior chamber. An ab externo incision was used superiorly and an attempt was made to free the adherent cyst from the posterior corneal surface with a spatula. This was not successful and the adhesion was cut with scissors. A large iridectomy was made from 10- to 2-o'clock positions. The vitreous face, which was adherent to the cyst and iris, was broken and vitreous was lost. This necessitated closure of the wound without further dissection of the epithelial tissue. It was thought that part of the epithelial cyst was left in the eye.

Postoperatively the tension remained around

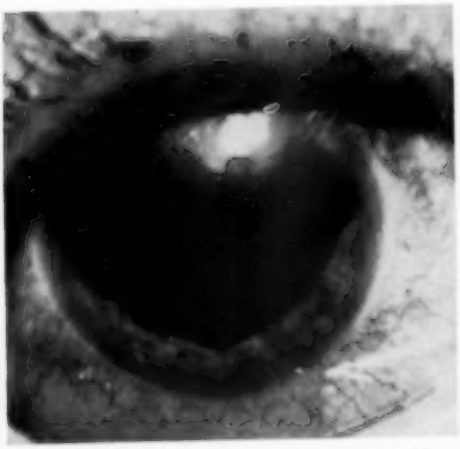

Fig. 7 (Maumenee and Shannon). Same as Figure 6, two months after surgical removal of cyst.

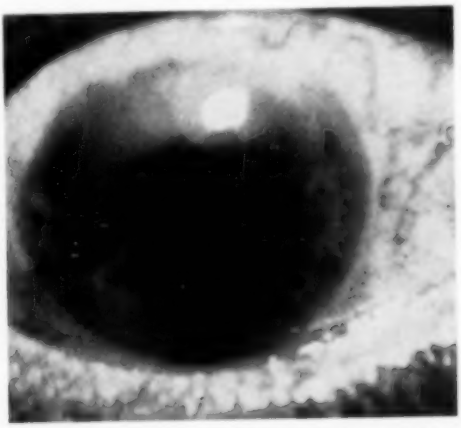

Fig. 8 (Maumenee and Shannon). Same as Figure 6, 23 months after surgical removal of epithelial cyst. Note corneal edema above.

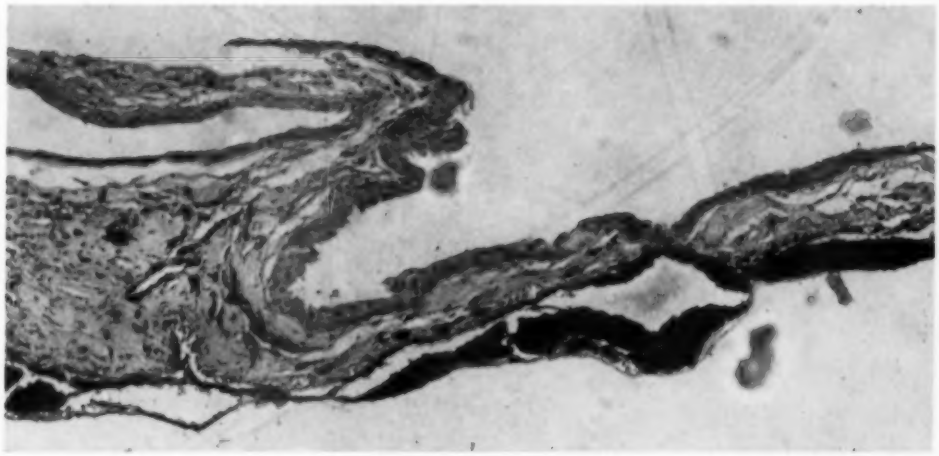

Fig. 9 (Maumenee and Shannon). Microphotograph of stratified squamous epithelium removed from eye of Case 4.

40 mm. Hg (Schiøtz) and could not be controlled by miotics. A cyclodialysis was done in October, 1950. Following this, tension remained within normal limits with the use of miotics.

The patient was last seen in March, 1955. There was no evidence of recurrence of the cyst. The glaucoma was well controlled with pilocarpine, two percent, four times a day. Visual acuity was 20/70+. There was a slight clouding of the cornea above as a result of vitreous adhesions to the cornea.

Histologic examination of several fragments of iris revealed considerable atrophy of the stroma. There was no particular inflammatory reaction in the tissue. The anterior surface of the iris was covered in places with surface epithelium two to six cells in thickness. In other areas the epithelium appeared to invade the iris stroma.

CASE 6

M. B., an 81-year-old white woman, had an intracapuslar cataract extraction on her right eye in 1949.

Unfortunately, only a brief summary of this patient's history was available. Apparently pain and photophobia developed in the right eye in December, 1950, and a diagnosis of epithelial cyst of the anterior chamber was made. This was treated by irradiation. The amount and nature of the radiation is unknown.

The patient was first seen by a member of the staff of the Stanford University Hospital in February, 1952. At this time the cyst filled the anterior one third of her chamber and extended from the 8- to 12-o'clock positions. It was in contact with the wound above. Visual acuity was reduced to 20/50. The patient had a secondary glaucoma which was controlled with pilocarpine (two percent) four times a day.

On February 24, 1952, the cyst was removed from the anterior chamber by performing a large iridectomy above. No attempt was made to curette the epithelium from the back of the cornea. However, when the cyst collapsed it did not appear to be firmly adherent to the cornea above. The patient was last seen in February, 1953. Her visual acuity was 20/30 and there was no evidence of recurrence of the cyst nor any evidence of epithelial downgrowth. Tension was controllable with miotics.

Histologic study of the biopsied material disclosed a wrinkled fragment of iris, the anterior layer of which was covered by stratified squamous epithelium. There was considerable hyalinization of the iris stroma and a moderate infiltration of the tissue by lymphocytes and plasma cells.

CASE 7

R. C., a seven-year-old boy, had an extracapsular cataract extraction done on the right eye for a congenital cataract on February 20, 1947. Five months later a discission of a secondary membrane in the pupillary area was done. Following this he developed a secondary glaucoma which was not controlled by miotics. On August 22, 1947, a basal iridectomy and cyclodialysis were performed.

By July, 1948, an epithelial cyst was noted in the anterior chamber. The pupil was drawn up to the area of the old cataract incision and the cyst measured 2.0 by 3.0 by 1.5 mm. On July 29, 1948, a keratome incision was made temporal to and below the cyst. A diathermy electrode was inserted into the anterior chamber through this incision. Enough current was used to shrink the cyst to about one fourth of its former size and the electrode was then withdrawn.

In January, 1949, an iridectomy was done and in May of the same year a discission was done in an attempt to clear the pupillary space. In February, 1951, it was noted that the epithelial cyst had

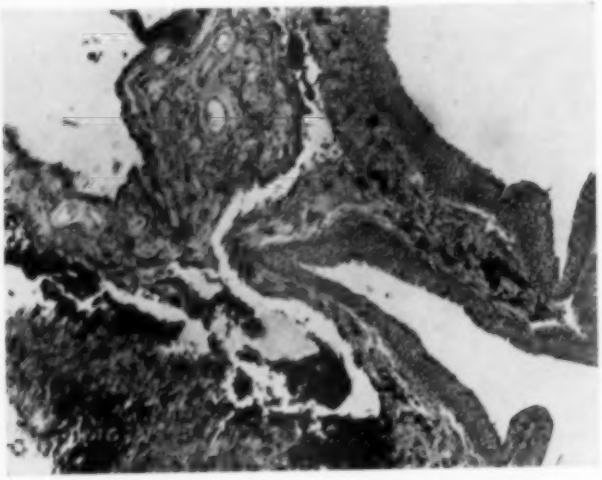

Fig. 10 (Maumenee and Shannon). Microphotograph of epithelium removed from eye of Case 8.

recurred, and on March 15, 1951, the cyst was freed from the posterior surface of the cornea above with an iris spatula. A large iridectomy was done in this area and the cyst removed.

The patient was last seen in March, 1955, at which time there was no evidence of recurrence of the epithelial cyst. However, he still had a secondary glaucoma and his visual acuity was reduced to light perception. There was a severe dystrophic change in the cornea.

Microscopic examination of the excised material revealed stratified squamous epithelium two to four cells in thickness, covering fragments of lens capsule, uveal pigment, and iris stroma.

CASE 8

A. R., a 55-year-old white woman, was first seen at the Stanford University Hospital in 1953. She gave a history of cataract extraction on her left eye six years previously. Her presenting complaint was a "veil" forming over the left eye for the past three or four months. On examination there was a large epithelial cyst extending from the 8- to 12-o'clock positions and occluding most of the pupil. The cyst filled approximately one half of the anterior chamber. The nasal pillar of the iris was incarcerated in the lips of the old surgical wound, and epithelium had probably invaded the anterior chamber from this point. Visual acuity was 20/40 corrected and tension was 20 mm. Hg (Schiøtz). On June 22, 1953, a large iridectomy was done in the region of the cyst and the posterior surface of the cornea was gently curetted. A small amount of vitreous was lost during the operative procedure.

The patient's postoperative course was uneventful and her visual acuity improved immediately following the operation. However, when she was seen in March, 1955, her visual acuity was reduced to 20/80 due to some clouding of the capsular remnants. There was no evidence of recurrence of the cyst and the intraocular pressure was normal.

Histologic study of the specimen revealed that the iris stroma was moderately infiltrated with lymphocytes and showed considerable depigmentation. A long sheet of squamous epithelium covered the iris and appeared to invade the iris stroma in some areas (fig. 10).

CASE 9

R. S., a 64-year-old white woman, had an uncomplicated intracapsular cataract extraction on her left eye in March, 1953. In April, her corrected visual acuity was 20/20. In August, 1953, a grayish translucent cyst was noted in the anterior chamber at the 2- to 3-o'clock position. The lesion showed definite evidence of growth over a period of three weeks. There was no evidence of iritis or glaucoma. In October, the cyst was excised from the anterior chamber and a peripheral iridectomy was done. There was no loss of vitreous. The patient was last seen in March, 1955, at which time the visual acuity was 20/20+. There was no evidence of recurrence of the cyst. The cornea was clear and intraocular pressure was normal.

This specimen was not sent to the Eye Pathology Laboratory for examination.

CASE 10

D. B., a 30-year-old white woman, had had bilateral, chronic, granulomatous uveitis since 1938. On May 28, 1952, an intracapsular cataract extraction with complete iridectomy above was performed on the left eye. The postoperative course was uneventful and her visual acuity improved to 20/70. Six months postoperatively, a small epithelial cyst was noted over the temporal pillar of the iris in the left eye. The cyst was evacuated through a needle which was insulated to its tip. A diathermy current was then applied to coagulate the walls of the cyst. The cyst reformed and five months later,

in April, 1953, it was again treated in a similar manner.

The patient was first seen at the Stanford University Hospital in July, 1953, at which time a small epithelial cyst was noted over the temporal pillar of the iris of the left eye. The cyst appeared to invade the posterior chamber and filled approximately one tenth of the anterior chamber. Her uveitis was inactive and intraocular pressure was normal. Her visual acuity was approximately 20/300. The epithelial cyst increased somewhat in size and on September 9, 1953, the lesion was removed by an ab externo incision and an iridectomy in the area of the cyst. There was no loss of vitreous. A small anterior chamber hemorrhage filled the lower one fifth of the anterior chamber.

The postoperative course was uneventful except for a mild flare-up of her uveitis. The patient was last seen in July, 1954, nine months postoperatively. There was no evidence of recurrence of the cyst, intraocular pressure was normal, and visual acuity was approximately hand motions at 15 feet.

Histologic examination of the material revealed typical surface epithelium.

CASE 11

C. S., a 49-year-old white woman, stated that, when she was approximately two years old, she punctured her right eye with a hatpin. Apparently this produced a traumatic cataract and reduced her visual acuity in this eye to light perception. In 1934, when she was 29 years of age, a small cyst was noted on the posterior surface of the cornea in the right eye. This gradually increased in size but had remained stationary for the four or five years preceding her first examination at the Stanford University Hospital. When the patient was about 10 years old, her right eye deviated outward. In 1934 an operation was performed to straighten this eye.

The patient was first seen at the Stanford University hospital on February 9, 1954, at which time she requested that the cyst be removed from the anterior chamber, her white pupil be corrected, and her eye straightened.

On examination the patient showed a right exophoria of 20 to 30 prisms diopters. The ocular tension and pupillary reaction were normal. There was a small pearl-gray epithelial cyst in the anterior chamber which was connected to the posterior surface of the cornea at the site of the old puncture wound. The cyst did not grow far enough into the anterior chamber to rest on the surface of the iris (Fig. 11). Remnants of lens capsule and cortex filled the pupillary space with a whitish mass. Visual acuity in the right eye was limited to accurate light projections and hand motions at one foot. The eye was not operated upon for it was thought that the cyst was quiescent.

COMMENT

The cases here reported confirm the oft-repeated observation that the primary cause

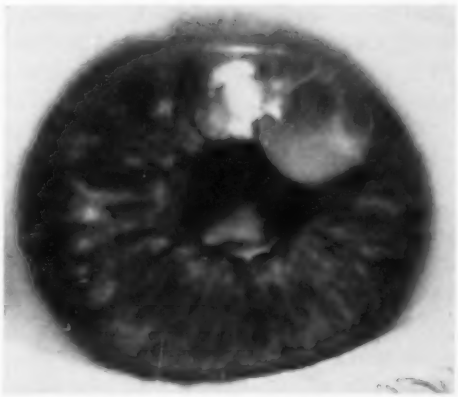

Fig. 11 (Maumenee and Shannon). *Case II.* Epithelial cyst on posterior surface of cornea.

of an epithelial cyst or downgrowth into the anterior chamber is an improper closure of a wound or incision. However, several of the patients reported what they believed to be a normal postoperative or posttraumatic course. Since only one of these patients was operated upon at the Stanford University Hospital, it has been impossible to check the accuracy of these histories. Since in eight of these patients the cyst was noted in an area where the iris was included in the wound, it is highly probable there was a delayed closure of the incision, even though this was not mentioned in the history obtained.

It is interesting to note that in no instance has an epithelial downgrowth followed removal of a cyst, nor has there been any evidence of a recurrence of a cyst which has been adequately removed with an accompanying large iridectomy. This absence of secondary recurrence or other complications has been confirmed by a fairly adequate postoperative follow-up—an average of two years, nine months.

While no attempt has been made in this series to compare the efficiency of surgical removal of an epithelial cyst from the anterior chamber to other forms of therapy, it might be mentioned that the only other type of treatment which might theoretically

give comparable results to surgical removal would be coagulation of the cyst by diathermy current or electrolysis. This had been previously attempted elsewhere in two patients of this series and had been unsuccessful. However, it might be satisfactory where the cyst is small enough to permit the destruction of the epithelium which is adherent to the posterior surface of the cornea or is in contact with the surface of the iris.

Several conclusions may be drawn as to indications for operation and the technique of removal of these cysts. The interval between the initial injury and the development of the cyst may possibly be explained by postulating that, while the cyst develops soon after trauma, it remains small in size and dormant until stimulated by some unknown factor to produce a proliferation of epithelial cells. Therefore, a small epithelial cyst on the posterior surface of the cornea which is asymptomatic and not growing should be merely observed (Case 11). Surgical removal is indicated if the cyst is increasing in size, is producing an iridocyclitis, or is occupying one third to one fourth of the anterior chamber.

As concerns actual surgical technique, the cyst should be aspirated and collapsed with a small 24- to 27-gauge needle prior to entering the globe. When this is done it is possible to determine where epithelium is firmly adherent to the posterior surface of the cornea and where it is merely in apposition. The lesion should then be approached through an ab externo incision made near the base of the iris. The incision should be extended further around the circumference of the anterior chamber than the actual area of the cyst (that is, if the cyst extends from the 9- to 12-o'clock positions, the incision should be from the 8- to 1-o'clock positions). This scleral approach will allow the removal of the maximal amount of epithelium from the angle of the anterior chamber.

After the unattached cyst wall has been removed with intracapsular cataract forceps, the epithelium should be removed from the back of the cornea by gentle curettage or by swabbing with an applicator dipped in 70-percent alcohol and wrung relatively dry. Caution should be used in denuding the cornea, especially in aphakic eyes, for vitreous may become adherent to bared cornea and produce a persistent localized area of edema. It is wise not to curette beyond the area of the attached epithelium or more than three to four mm. from the limbus. Epithelial cells more than this distance from the periphery will probably not survive when the cells nearer to the angle have been removed. Finally, a large basal iridectomy should be done over the entire area where epithelial tissue is adherent to the surface of the iris.

The surgical technique described above does not insure the removal of every epithelial cell from the anterior chamber. However, the high percentage of good operative results suggests that if the majority of epithelial cells are removed from the iris and corneal surfaces, those left in the aqueous and angle will not proliferate.

There are numerous reasons for the belief that the aqueous is not a good nutrient media for surface epithelium:

First, there is an infrequent occurrence of epithelial cysts or downgrowths into the anterior chamber.

Second, difficulty is encountered in attempting to produce such lesions in eyes of experimental animals.

Third, the cyst may remain small with no evidence of growth on the posterior surface of the cornea for 30 to 40 years. This usually happens when the epithelial tissue is in contact only with the corneal surface and is not in contact with the iris.

Fourth, histologic examination shows that the basal or actively multiplying cells of an epithelial cyst or downgrowth are in contact with the corneal or iris surface, and are probably receiving their nourishment from these tissues.

Finally, epithelial downgrowths usually do not grow as rapidly over the posterior

surface of the cornea as they do over the anterior surface of the iris.

It was stated previously that the clinical course is more benign and prognosis for treatment is better in patients with epithelial cysts than it is for those with epithelial downgrowths. It was also implied that the mechanism of production of these two conditions was somewhat different. However, a study of these cases has not revealed why one type of lesion occurs instead of the other.

A possible explanation for the difference in the clinical course of cysts and downgrowths is that, in the first instance, the wall of the cyst is exposed to aqueous and this tends to hold back the advancing edge of epithelium on the surface of the iris and cornea. Therefore, the cyst will not usually grow as rapidly as the downgrowth. Likewise, the cyst is more opaque and easier to see than the downgrowth and is therefore detected and treated earlier. The area of involvement of the anterior chamber can be easily observed in a cyst, whereas with a downgrowth it is difficult to determine how far the epithelium extends over the iris and into the angle. For this latter reason, most of the epithelium can be removed surgically in the presence of a cyst, whereas in a downgrowth this is much more difficult.

Contrary to what has been previously reported in the ophthalmic literature these cases indicate that, if most of the epithelium is removed from the iris and cornea in the case of a downgrowth, the patient might be cured rather than made worse by the surgical procedure.

Conclusions

1. A clear distinction should be made between epithelial pearl tumors, epithelial cysts, and epithelial downgrowths of the anterior chamber. The clinical course, suggested therapy, and prognosis are different for each of these lesions.

2. Early surgical removal or treatment is indicated when epithelial cysts are growing or producing a chronic iridocyclitis.

3. Large iridectomies should be performed in the area of the epithelial cyst adjacent to iris. In areas where the epithelial cyst is adherent to the posterior corneal surface the epithelial cells should be removed by curettage or by an alcohol swab.

The Johns Hopkins Hospital (5).

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C-REACTIVE PROTEIN IN OPHTHALMOLOGY*

Clinical and experimental studies of its use

Michael I. Wolkowicz, M.D., Joseph W. Hallett, M.D., and Irving H. Leopold, M.D.
Philadelphia, Pennsylvania

Historical review

In 1930, Tillett and Francis demonstrated, in the serum of patients infected with gram-positive bacteria, the existence of precipitins which flocculate in the presence of a nitrogenous carbohydrate C-polysaccharide common to pneumococcus species. Ash, in 1933, claimed to have found the precipitins reacting to the C-polysaccharide in illnesses due to gram-negative as well as gram-positive organisms. Syphilitic infections gave a consistently negative response, whereas the results in tuberculous disease were positive in a small percentage of cases.

In 1934, Francis and Abernathy (quoted by Abernathy and Avery) published a report on a skin reaction following intracutaneous injection of 0.1 mg. of C-carbohydrate in patients during the acute stage of pneumonia. The precipitins or C-reactive protein (CRP) appeared to be specific to man and monkey, since Abernathy, in 1937, reported negative tests with serum from infected rabbits, whereas serum from infected monkeys responded to the C substance.

McLeod and Avery were able, in 1941, to identify the C-reactive protein and separate it from serum albumins through its insolubility in tap water. In a subsequent report they made exhaustive studies of the immunologic reactions resulting from the injection of human C-reaction protein into rabbits. The precipitins formed in the rabbit serum following injection with human C-reactive protein proved to be highly specific for C-protein and precipitated weakly or not at all to other proteins normally present in human serum. This reaction became the basis of a simple, easily performed laboratory test used in those studies.

The C-reactive protein test became further simplified when rabbit C-reactive protein antiserum (CRPA) became commercially available.† The C-reactive protein could be detected by this method in human serum diluted to 1:500, whereas dilutions of purified C-reactive protein as high as 1/240,000 still showed a positive response.

Independently Lofstrom conducted parallel studies by using serum from patients ill with pneumococcus type 27 and observed the capsular swelling in cases in which a good

* From the Research Department, Wills Eye Hospital.

† Courtesy of Schieffelin and Company.

fever reaction was produced. His clinical material included pulmonary tuberculosis, virus disease, meningitis, cardiac infarction, and so forth. The tabulated results are beyond the scope of this paper but it suffices to mention for the purpose of our studies that abacterial exudates showed a positive reaction in eight out of 10 cases, whereas it was lacking in the bacterial exudate despite a high content in the blood samples. It was not possible to demonstrate a positive reaction in the cerebrospinal fluid in cases of bacterial or abacterial meningitis.

In his subsequent report Lofstrom showed the similarity in the reaction of sera from patients in the acute stage of a generalized infection (the so-called acute-phase serum) with pneumococcus C polysaccharide and with capsular swelling of pneumococcus type 27.

Hedlund, in 1947, using the capsular swelling technique, investigated 2,000 patients. Among them were two cases of iritis giving a negative serum reaction. He concluded from those studies that the formation of protein in acute-phase serum is either a sign of infection or reaction of the body against degenerative products.

A detailed method crystallizing the C-reactive protein was described by McCarty in 1947 when he made an interesting clinical observation having some bearing on our investigations. Abdominal fluid from a patient suffering from cirrhosis of the liver was negative for C-reactive protein but became positive during an intercurrent infection. He concludes his article with this highly interesting and thought-provoking statement:

"The reaction between the pneumococcal C-polysaccharide and the C-reactive protein is a phenomenon based on chance complementary relationship between the molecular configuration of the two substances which, in the presence of calcium ion, results in the formation of an insoluble complex. C-reactive protein may be only one of several new constituents that appear in the blood in small amounts during the course of disease, and others have not been demonstrated in greater numbers simply because specific reagents for their detection comparable to C-polysaccharide are not available."

Laboratory material for experimental use became available after Anderson and McCarty were able to demonstrate the existence of a different type of C-reactive protein, labeled CRPx, in the rabbit serum reacting with a different type of pneumococcal polysaccharide, called Cx polysaccharide, in the same manner as the human C-reactive protein reacts with C-polysaccharide. In their original article, the authors produced CRPx antiserum by injecting rabbit CRPx in the rooster but, in his personal communication, McCarty mentions a preferable antiserum produced in sheep. It is the sheep antiserum, available through the generosity of Dr. H. F. Wood, which we used in our experimental work.

Quantitative measurements of C-reactive protein in human sera were made by Wood and McCarty in 1951 by a spectrophotometric method. Their technique shows that positive C-reactive protein antiserum reactions can be obtained in sera with less than 0.01 mg. of C-reactive protein per cc. In acute stages of rheumatic fever, C-protein can reach concentrations of 0.33 mg. per cc.

It is easy to speculate that there exists a close relationship between the intensity of the stimulus causing the appearance of C-protein and the level of C-reactive protein in the blood. Since fever producing inflammations have been, with few exceptions, also productive of C-reactive protein in the blood one may further reason that anterior or posterior uveitis is not a sufficient stimulus to produce C-reactive protein in the blood or produces it in quantities too small to be detected by our laboratory methods. In fact, Hedlund's two cases of iritis included in his 1947 studies were negative although his technique of capsular swelling is less sensitive than the antiserum method used in our studies.

Procedure

The C-reactive protein antiserum test is a simple procedure in which a 1.5 to 2.0 cm. column of C-reactive protein antiserum and then a small volume of patients' serum are drawn into a capillary tube. A more intimate contact between the two sera is established by turning the tube upside down and permitting an air bubble to settle in the lower section of the tube. The capillary tube is now set in a pipette rack containing plasticin in its base. The entire set, which may contain several capillary tubes, is incubated for two hours at 37°C. and then placed overnight in the refrigerator (at about 4°C). Any precipitate formed in the capillary tube may be classified according to the height of the column in mm. anywhere from 0 (no visible reaction) to 6+ (height of precipitation 6.0 mm. or more).

Clinical investigation

The present studies are considered preliminary and were made to determine the applicability of the C-reactive protein antiserum reaction in ophthalmology.

The sera of 103 private and clinic patients were tested for the presence of C-reactive protein (Table 1). The technique for collecting the blood serums was the same as currently used for serologic tests. The patients have been divided into four groups:

TABLE 1

Data on patients studied

Case No.	Age	Sex	Ocular Diagnosis	Medical History	C-Reactive Protein Antiserum
1. M.M.	55	F	Bilat. macular choroiditis	Normal	0
2. T. M.	73	F	O.D. ant. uveitis	Normal	0
3. B. B.	27	M	Normal	Rheumatic fever 1954	0
4. C. B.	31	F	Normal	Boeck's sarcoid (lungs); rheumatoid arthritis	0
5. F. S.	39	M	Central active choroiditis	Rheumatic heart disease	0
6. D. P.	30	M	O.D. traumatic iridocyclitis	Normal	0
7. L. W.	24	F	Normal	Normal	0
8. M. McC.	23	F	Normal	Normal	0
9. A. H.	54	F	O. S. central choroiditis	Normal	0
10. B. B.	22	F	O.S. acute iritis	Normal	0
11. M. G.	32	F	Active uveitis O.U.	Infectious mononucleosis Jan. 1952	0
12. M. P.	40	M	O.D. acute iritis	Normal	0
13. J. N.	39	M	O.D. dendritic ulcer / anterior uveitis	Normal	0
14. T. S.	29	F	Normal	Normal	0
15. J. G.	63	F	O.D. active choroiditis	Normal	0
16. F. O.	53	M	Toxic neuritis O.U. (tobacco-alcohol)	Receiving typhoid therapy	3+
17. J. W.	28	M	O.S. acute uveitis	Receiving typhoid therapy	2+
18. V. M.	4	F	Iridocyclitis O.U.	Receiving typhoid therapy	3+
19. C. M.	37	M	O.S. traumatic uveitis / retinal detachment	Receiving typhoid therapy	4+
21. J. H.	44	M	Normal	Normal	0
22. E. B.	39	F	O.D. anterior uveitis	Cortisone therapy	0
23. M. P.	40	M	O.D. acute iritis	Normal	0
24. E. K.	40	M	O.D. acute iritis	Active rheumatoid arthritis	1+
25. S. McG.	24	F	O.S. active choroiditis	Cortisone, penicillin, streptomycin systematically	0
26. B. G.	28	M	Normal	Normal	0
28. S. E.	26	M	Normal	Normal	0
29. S. W.	32	M	Normal	Normal	0
30. H. P.	23	M	Normal	Normal	0
31. K. S.	21	M	Normal	Streptococcal throat infection 1 mo. ago	2+
32. C. S.	22	M	Normal	Normal	1+
33. C. L.	20	M	Normal	Normal	0

TABLE 1 (*continued*)

Case No.	Age	Sex	Ocular Diagnosis	Medical History	C-Reactive Protein Antiserum
34. W. C.	25	M	Normal	Malaria 1949	0
35. J. McC.	26	M	Normal	Normal	0
36. W. McK.	59	M	Normal	Normal	1+
37. W. J.	41	M	Normal	Normal	0
38. J. M.	39	M	Normal	Normal	0
39. J. O.	18	M	Normal	Normal	0
40. K. D.	21	F	Normal	Normal	0
41. A. H.	27	M	Normal	Normal	0
42. R. J.	56	F	O.D. chronic uveitis O.S. phthisis bulbi	Normal	0
43. G. F.	56	F	O.D. anterior uveitis	Normal	0
44. R. M.	31	M	Active uveitis O.U.	Malaria in 1942; receiving typhoid therapy	4+
45. E. K.	40	M	O.D. acute iritis	Receiving autogenous vaccine injections	2+
46. W. H.	28	M	O.D. traumatic iritis	Normal	0
47. M. W.	44	M	Normal	Pulmonary tuberculosis 1928	0
48. C. G.	17	M	O.D. keratouveitis disciform	Normal	4+
49. J. W.	34	M	O.D. active uveitis (choroiditis)	Mantoux strongly positive; recurrent malaria since 1942	3+
50. M. K.	35	F	O.S. active uveitis	Normal	0
51. P. C.	68	M	O.S. acute choroiditis	Normal	0
52. F. L.	34	F	O.D. acute iritis	Normal	0
53. F. J.	40	M	O.D. acute uveitis	Normal	0
54. G. S.	66	M	Open-angle glaucoma O.U.	Normal	0
120. T. N.	75	F	O.S. follicular conjunctivitis	Normal	0
121. C. D.	57	M	O.D. active uveitis	Receiving typhoid therapy	2+
159. J. D.	45	M	Open-angle glaucoma O.U.	Normal	0
160. C. G.	71	F	Open-angle glaucoma O.U.	Normal	0
181. G. R.	46	M	Central serous retinopathy O.U.	Receiving thyphoid therapy	3+
245. R. S.	41	F	O.D. active choroiditis	Diabetic	0
246. F. R.	26	M	O.S. Chronic posterior uveitis	Normal	0
266. M. B.	41	F	Essential iris atrophy O.U.	Normal	0
288. K. W.	33	M	O.S. dendritic ulcer	Receiving typhoid therapy and antibiotics	5+
292. J. B.	55	M	Open-angle glaucoma O.U.	Normal	0
332. E. S.	60	F	O.D. active uveitis	Normal	0
333. J. W.	34	M	O.D. active uveitis	Normal	1+
354. E. H.	66	F	Open-angle glaucoma O.U.	Normal	0
355. E. Z.	43	F	O.D. follicular conjunctivitis	Normal	0
356. A. H.	55	F	O.D. active central choroiditis	Healed pulmonary T.B. Carcinoma of the uterus 1947; chrysotherapy for arthritis	2+
358. S. R.	48	M	Open-angle glaucoma O.U.	Normal	0
359. M. P.	40	F	O.S. active uveitis Sec. glaucoma	Receiving typhoid therapy and ACTH	1+
360. V. C.	27	F	O.S. active uveitis	Normal	0
361. J. B.	14	M	Uveitis active, bilateral	Receiving fever therapy	2+
362. J. B.	27	M	O.D. active uveitis	Receiving typhoid therapy	3+
363. E. H.	24	M	O.D. active uveitis	Receiving typhoid therapy	3+
291. M. D.	74	F	Open-angle glaucoma O.U.	Normal	0
364. H. C.	67	M	O.S. active uveitis	Receiving typhoid therapy and ACTH	2+
365. L. C.	47	M	O.D. acute iritis	Normal	0
371. W. McC.	28	M	O.D. malignant melanoma of the choroid	Normal	0
381. E. M.	59	M	Open-angle glaucoma O.U.	Normal	0
481. F. V.	67	M	O.S. central vein occlusion	Normal	2+
485. R. J.	15	M	Normal	Normal	0
486. J. C.	16	M	Normal	Normal	0
487. A. P.	39	M	O.S. recurrent active uveitis	Received typhoid therapy 1 yr. ago	1+
488. E. B.	40	F	O.D. {anterior uveitis glaucoma	Normal	0
490. J. P.	51	F	O.S. chronic control choroiditis	Normal	1+

TABLE 1 (*continued*)

Case No.	Age	Sex	Ocular Diagnosis	Medical History	C-Reactive Protein Antiserum
491. G. B.	48	F	O.S. active central choroiditis	Normal	1+
492. A. McG.	42	F	O.D. active posterior uveitis O.S. macular degeneration	Receiving typhoid therapy	2+
493. S. T.	71	F	O.D. senile cataract	"Blood disease" requiring repeated transfusions	2+
495. M. C.	78	F	Senile cataracts O.U.	Normal	0
496. P. J.	11	M	O.D. active choroiditis	Normal	0
497. M. D.	52	M	Disseminated chorioretinitis O.U.	Receiving typhoid and ACTH	2+
498. L. M.	64	F	O.D. anterior uveitis Sec. glaucoma	Normal	0
499. J. McG.	36	M	Acute plastic iritis recurrent O.U.	Iritis always begins with a boil somewhere on the skin	2+
500. S. T.	20	M	O.D. active uveitis	Possible Boeck's sarcoid; received typhoid therapy 4 mo. previously	1+
501. C. O.	35	F	O.D. anterior uveitis (nodular iritis acid fast)	Received 20 injections typhoid vaccine in 1949	6+
502. J. McG.	4	M	Alternating estropia	Normal	0
503. S. C.	48	M	O.D. {Anterior uveitis Sec. glaucoma	Luetic under treatment since 1941	1+
504. H. S.	47	M	Acute plastic iritis O.U.	Normal	0
505. J. D'O	28	F	O.S. active central choroiditis	Elephantiasis lower extermities; infected tooth extracted day before	1+
506. E. N.	47	M	O.D. acute iritis	Normal	0
507. N. P.	6	M	Acute uveitis bilateral	Rheumatic heart disease; receiving Pen-strep. injections	3+
508. W. McN.	12	M	Acute iritis bilateral	Receiving Pen-strep. injections and typhoid therapy	3+
509. C. M.	47	F	O.S. acute anterior uveitis	Normal	0
510. M. T.	53	F	O.D. {acute anterior uveitis Sec. glaucoma	Normal	0

1. *Normals* by which we mean patients not suffering from an inflammation of the internal structures of the eye. This heterogeneous group was actually a miniature cross-section of the population, the ages varying from four to 78 years, and included patients with refractive errors, minor eye inflammations (like a follicular conjunctivitis), research laboratory workers, and so forth.

2. *The glaucoma group* was mainly recruited from the glaucoma clinics of the Wills Hospital. All the patients included in this study were currently under treatment for open-angle glaucoma.

3. *Uveitis.* Under the heading of "uveitis" were all patients treated either on an outpatient basis or hospitalized for an active phase of uveitis. Since this was primarily a pilot study, in which the statistical analysis would have only directional value, the relatively small number of cases was judged to be sufficient and no attempt was made to break down this group into granulomatous, nongranulomatous, anterior, or posterior uveitis.

4. *Fever therapy.* The last group comprised patients currently under fever therapy (intravenous typhoid), some of them receiving ACTH on alternating days. These patients were hospitalized at the time of study, all (with the exception of three) were being treated with fever therapy for some form of active uveitis.

Comment

From a study of Table 2 one may conclude:

1. The underlying pathologic process in open-angle glaucoma appears to be unrelated to the appearance of C-reactive protein. "0%" of positive results may be misleading,

TABLE 2

SUMMARY OF CRPA RESULTS

Grouping	CRPA+	%	CRPA−	%
Normals	5	18.5	27	81.5
Glaucomas	0	0.0	8	100.0
Uveitis	15	32.0	32	68.0
Typhoid therapy	16	100.0	0	0.0

due to the small number of cases. One may surmise that a large series of glaucoma cases would have given the same percentage of positive results as the normal group.

2. Patients under typhoid therapy will invariably show a positive C-reactive protein antiserum determination. This, as well as the time of appearance of the C-reactive protein in the blood (approximately 18 hr. after the onset of fever), are well in accord with the previously mentioned reports.

3. A certain number of "normal" individuals (in this instance the word "normal" should be interpreted as "free from present or past uveal inflammation"), if chosen at random irrespective to age, sex, and past medical history, will give a certain percentage of positive C-reactive protein antiserum determinations. Since information concerning the appearance of C-reactive protein in the blood is far from complete, one can attempt to interpret those results by analyzing the patient's past record.

Case 31 had recently recovered from a "streptococcal throat infection." Cases 32 and 36 both show good health, and their past history gives no clues as to the positive C-reactive protein antiserum reaction. Case 481 is interesting; the ocular diagnosis is central retinal vein occlusion in the left eye, presumably on an arteriosclerotic basis. This case, while statistically insignificant, gives rise to some speculation, since Hedlund, and recently Kroop and Shackman, indicated that C-reactive protein was present in myocardial infarction. The last patient (Case 493) with a positive C-reactive protein antiserum test was a 78-year-old woman with senile cataracts, whose past history revealed that she was suffering from a "blood disease" for which she had to receive repeated blood transfusions.

4. The analysis of active uveitis cases indicates that determination of the C-reactive protein antiserum in the blood is not reliable for ocular diagnostic purposes, since only 15 out of a group of 32 cases showed a positive reaction. However, it acquires a certain significance if one compares those figures with the ones in the so-called "normal" group. One may doubt if acute nonspecific uveitis is able, per se, to act as a stimulant for the production of C-reactive protein. The study, however, suggests that there is a larger proportion of patients with systemic involvement adequate enough to provoke the formation of C-reactive protein. Examples among the 15 cases illustrate this point.

Case 24 was diagnosed as acute plastic iritis of the right eye. He suffered from severe rheumatoid arthritis and at the time of this study was receiving autogenous vaccine. Case 49 had active choroiditis of the right eye. Laboratory studies revealed a strongly positive Mantoux test. He contracted typhoid fever in childhood and malaria in 1942. Case 356 had active choroiditis of the right eye. Medical history revealed rheumatoid arthritis treated with crysotherapy, healed pulmonary tuberculosis, cancer of the uterus, treated with radiations in 1947.

Cases 490 and 491 showed a weak positive C-reactive protein antiserum reaction although their past medical history was not remarkable. Both are suffering from an active posterior uveitis. Case 501 had an anterior granulomatous uveitis strongly suggestive of a tuberculous process and his past history revealed that he feceived 20 typhoid injections in 1949. C-reactive protein antiserum was strongly positive. Case 500 was suspected as being one of Boeck sarcoid disease. The patient had received typhoid therapy four months previously. His blood serum showed +1 C-reactive protein antiserum reaction.

These cases show that a larger percentage of patients with active uveitis will give posi-

tive C-reactive protein antiserum determinations than a similar group of individuals without uveitis chosen at random. From this one may further infer that, in a certain proportion of cases, the etiologic factor initiating the process of an active uveitis, be it toxic or infectious, belongs to the large group of systemic conditions capable of stimulating the appearance of C-reactive protein in the blood serum.

Laboratory experiments

Animal experiments were performed on rabbits. The technique for the production of and experimental uveitis closely followed the one described by Bjorn Foss. After two instillations of 0.5 percent pontocaine, the eye was proptosed by an assistant with a muscle hook. The operator grasped the superior rectus with a fixation forceps and the eye was rotated downward; 0.1 cc. antigen suspension was injected intravitreally, through a 27-gauge needle, by puncturing the sclera seven to eight mm. behind the limbus. The needle was aimed posteriorly at a sloping angle to avoid injury to the lens.

The materials used in these experiments were sterile horse serum, stock suspension of killed typhoid and paratyphoid bacilli (100 million organisms per cc.), hemolytic Staphylococcus aureus (100 million organisms per cc.), and Streptococcus beta hemolyticus (100 million organisms per cc.). The latter, however, had to be discontinued since, in our hands, it proved to be highly lethal, killing the rabbit before any reliable sampling could be taken.

The injection of horse serum produced a typical iridocyclitis of variable intensity on the seventh day. According to Bjorn Foss this is the primary anaphylactic iridocyclitis where the nonabsorbed particles of the antigen act as shocking dose to the sensitized animal. This reaction can, on occasions, be so mild as to pass unnoticed unless it is carefully searched for with a slitlamp. Subsequent shocking doses injected intravenously three weeks later will produce a more intense uveal reaction, although here, too, the eye may remain "white" to cursory examination.

Injection of a suspension of typhoid organisms usually produced a uveal reaction, noticeable the next day. Occasionally a few days would elapse before a complete picture of iridocyclitis became evident. A severe reaction consisted of posterior synechias, dense beam, and fibrinous exudates suspended in the aqueous. Ultimately, subcapsular lens opacities would appear. A suspension of staphylococci produced, invariably within 24 hours, chemosis, a dense flare, and synechias. This was followed shortly by clouding of the lens and ground-glass appearance of the cornea. Usually within a week the cornea became completely opaque and, if left alone, a perforation would ensue, extruding dense purulent material.

Results

Aqueous specimens were taken when slitlamp examination confirmed the diagnosis of iridocyclitis. The rabbit's eye was anesthetized with 0.5-percent pontocaine and the eye was immobilized in the same fashion as for intravitreal injection. The anterior chamber was entered with a 27-gauge needle mounted on a tuberculin syringe and approximately 0.15 cc. of aqueous was withdrawn. CRPx testing was done with sheep antiserum immediately upon withdrawing. Usually a smear and culture on a blood-agar plate were done at the same time. The small amount of blood serum needed for CRPx testing was obtained from the rabbit's ear by puncturing the marginal vein.

In rabbits injected with horse serum, primary, as well as secondary, aqueous humor showed no trace of C-reactive protein, whereas blood-serum reaction was faintly positive (+1). Cultures of the aqueous humor were negative for organisms.

Typhoid-injected rabbits behaved in a similar manner: aqueous negative for CRPx, blood serum weakly positive (+1). However, intravenous injection of typhoid was followed 24 hours later by a strongly posi-

tive reaction in the blood, thus resembling closely the effects observed in humans.

Rabbits injected with Staphylococcus hemolyticus aureus suspensions exhibited a 6+ reaction in the aqueous and blood serum five days after initial inoculation. It is interesting to note that, in one rabbit, the culture of the aqueous, five days after inoculation, was still sterile, although slitlamp examination disclosed a marked flare and the CRPx was strongly positive. When frank purulent material filled the anterior chamber, the CRPx became negative, in accordance with previous reports by Lofstrom. It must be stated, however, that, due to the turbidity of the tested fluid, the final readings are questionable.

Comment

The present study was undertaken to explore the potentialities of the C-reactive protein antiserum test in determining the etiology and differential diagnosis of various inflammatory eye conditions in general and uveitis in particular.

Blood serum testing proved to be of little help in diagnosis. A negative response confirmed the generally held belief that the chronic low-grade ocular infection is an inadequate stimulus for C-reactive protein formation to be detected by the present method. A positive response denotes a concurrent systemic condition, which can give a "false" positive reaction as far as the ocular diagnosis is concerned. A patient under fever therapy will show a positive blood-serum reaction and this finding is of no diagnostic significance. One can assume that a severe ocular inflammation (panophthalmitis, orbital abscess, and so forth) would give a positive serologic response, although this finding would be of no practical value since the ocular diagnosis is quite obvious.

The fact that a greater proportion of patients with active uveitis, as compared with a similar group of individuals with negative ocular findings, showed a positive C-reactive protein antiserum reaction may be of value. It suggests a relationship between uveitis and some systemic disorder capable of producing a strong enough stimulus to produce a positive C-reactive protein antiserum in the blood.

The C-reactive protein antiserum test performed on the aqueous humor might prove to be of value in helping to establish the etiology and classification of this large heterogeneous group of uveitis. These preliminary animal experiments indicate that, at least in rabbits, an anaphylactic uveitis will give a negative response, whereas a bacterial uveitis, even in the absence of the offending organism, will show the presence of C-reactive protein in the aqueous.

This illuminates another problem for which this test might be of clarifying value: Is the C-reactive protein in the aqueous humor produced in the eye, or did it enter the anterior chamber as a result of overflow from the blood stream? If the answer to the last question is "yes" how high a concentration of C-reactive protein in the blood is needed in order to appear in the aqueous?

An excellent paper recently published by Rudolph H. Witmer on experimental leptospiral uveitis in rabbits, which gives a detailed technique of comparing antibody titers in blood and aqueous, can, very likely, be applied to the C-reactive protein antiserum test. It would be interesting to see if the C-reactive protein is present in a granulomatous uveitis and if the C-reactive protein formation parallels antibody appearance in the aqueous.

Summary

1. A historical review is presented of the C-reactive protein test and its possibilities in ophthalmic diagnosis are discussed.

2. A total of 103 cases were analyzed in which the blood serum had been examined for the presence of C-reactive protein.

3. Patients with active uveitis showed a statistically significant elevation of their C-reactive protein antiserum blood as compared to patients with other ocular diseases (for

example, glaucoma) or those without ocular disease. Approximately 75 percent of the positive uveitis cases had a systemic disorder that accounted for the elevated C-reactive protein antiserum level.

4. Elevated C-reactive protein antiserum tests were found only in experimental uveitis induced by bacterial intracameral inoculation and not after other foreign protein intracameral injections.

1601 Spring Garden Street (30).

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THE CAUSES OF ACQUIRED PARALYSIS OF THE OCULAR MUSCLES*

C. Wilbur Rucker, M.D., John A. Dyer, M.D., Dale C. Smith, M.D., and Robert G. Taub, M.D.,
Rochester, Minnesota

A paucity of published information on the relative importance of the various causes of paralysis of the ocular muscles induced us to review the records in some of our own cases. The material utilized includes all cases of ophthalmoplegia we could locate in which examination had been done at the Mayo Clinic during the 10 years ending December 31, 1954. The list is incomplete because all diagnoses were not indexed but it can be considered fairly representative. We discarded instances of supranuclear lesions, birth injuries, congenital anomalies, and various disorders of the muscles themselves, such as myasthenia gravis, restricting our study to acquired paralysis of the extraocular muscles caused by lesions of the third, fourth, and sixth cranial nerves.

Results

The 653 cases that met our requirements were divided into six groups according to the nerve or combination of nerves in which paralysis was present, as shown in Table 1.

Third cranial nerve

In 70 of the group of 221 paralyses limited to the third cranial nerve (table 2), the cause was not determined during the time the patient was under our observation. Other signs undoubtedly appeared later in some of these instances and eventually led to a diagnosis at other hands.

Injury to the head accounted for 39 cases. The injury in about half of these cases was sustained in automobile accidents. Neoplasms are relatively uncommon as a cause of paresis of the oculomotor nerve, accounting for less than 10 percent of the cases in this group in our study. Among the 19 neoplasms, nine were metastatic and 10 arose primarily within the intracranial cavity; five of the latter were adenomas of the pituitary.

The paralysis in 31 instances was diagnosed as of "vascular" origin. As these diagnoses were based solely on clinical evidence of hypertension or arteriosclerosis, they were made tentatively, with the expectation that in some instances other evidence would appear later to confirm or to change the diagnosis. Some of the cases classified as "undetermined" might have been listed with justification as "vascular." Diabetes was present in six of the 31 cases in the latter group.

Aneurysm stands out as the most frequent cause of oculomotor paralysis, accounting for about 20 percent (45) of our cases. It appears to have replaced syphilis, which a few decades ago was regarded as the prime cause of oculomotor paralysis. Syphilis accounted for only five of our cases.

TABLE 1

Acquired ocular paralysis by nerve affected

Cranial Nerve Affected	Cases
III	221
IV	40
VI	246
III and IV	40
III and VI	60
III, IV, and VI	46
Total	653

TABLE 2

Causes of paralysis of cranial nerve III

Cause	Cases
Undetermined	70
Head trauma	39
Neoplasm	19
Vascular	31
Aneurysm	45
Syphilis	5
Other	12
Total	221

* From the Section of Ophthalmology, Mayo Clinic, and the Mayo Foundation. The Mayo Foundation is a part of the Graduate School of the University of Minnesota.

TABLE 3

PUPILLARY REACTION IN PARALYSIS OF CRANIAL NERVE III

Cause of Paralysis	Pupils Normal	Pupils Affected
Undetermined	53	17
Head trauma	17	22
Neoplasm	3	16
Vascular	24	7
Aneurysm	3	42
Syphilis	0	5
Other	7	5

TABLE 4

CAUSES OF PARALYSIS OF CRANIAL NERVE IV

Cause	Cases
Undetermined	15
Head trauma	12
Neoplasm	1
Vascular	8
Aneurysm	1
Syphilis	0
Other	3
Total	40

The other 12 cases in this group were attributed to a wide range of affections, including encephalitis (three), measles encephalitis (one), sarcoidosis (one), temporal arteritis (one), herpes zoster (two), abscess of the frontal lobe (one), ophthalmoplegic migraine (two) and injection of alcohol for trigeminal neuralgia (one).

We have noted isolated paralysis of a medial rectus muscle in a few patients afflicted with multiple sclerosis. This appears to be interpreted best not as an affection of the third nerve but as a variety of internuclear ophthalmoplegia, a relatively frequent finding in multiple sclerosis. The lesion involves the medial longitudinal fasciculus between the nuclei of the third and sixth nerves within the pons.

The pupillary reactions in the cases in which the third nerve was affected deserve mention (table 3). When the oculomotor paresis was due to neoplasm or aneurysm, the pupils were affected, with a few exceptions, either being dilated or exhibiting subnormal reactions. In the presence of syphilis, the pupils were affected in every instance. When the basis was vascular, the pupillary reactions most often were normal, suggesting that the involvement is nuclear rather than peripheral.

FOURTH CRANIAL NERVE

The 40 cases of paralysis of the fourth cranial nerve are listed in Table 4. The cause was not determined in more than a third (15). For want of a better diagnosis, the clinicians were inclined to call some of these lesions "vascular," but the nature of the supposed vascular lesion was so obscure that we have not felt justified in accepting that diagnosis in every instance in which it was made. The lesions listed in this table as "vascular" occurred in patients who had other evidence of hypertension or arteriosclerosis; three of them had diabetes.

Injury to the head was responsible for 12 cases, in two of which the trochlear paralysis was bilateral.

A glioma of the frontal lobe accounted for one case and an aneurysm at the circle of Willis accounted for one other. In the latter case, the paresis was slight and lasted for only a few days. In no instance was syphilis responsible for paralysis of a trochlear nerve.

Of the other three cases, two followed encephalitis and one was associated with bilateral facial paresis and probably was an instance of sarcoidosis.

SIXTH CRANIAL NERVE

Table 5 discloses that the cause was not determined in 90 of the 246 cases of paralysis of the sixth cranial nerve. Some patients did

TABLE 5

CAUSES OF PARALYSIS OF CRANIAL NERVE VI

Cause	Cases
Undetermined	90
Head trauma	34
Neoplasm	38
Vascular	40
Aneurysm	11
Inflammation	8
Syphilis	7
Multiple sclerosis	7
Other	11
Total	246

not remain to allow completion of the recommended studies; in some patients, other signs developed at a later date to enable examiners elsewhere to arrive at a diagnosis.

Injury to the head accounted for 34 cases, in about half of which the injury was incurred in automobile accidents. The lesions were bilateral in 10 of these 34 cases.

Brain tumors accounted for 38 cases. This number does not represent the real incidence of this lesion because of the method by which these statistics were gathered. Abducens paresis occurring as a relatively minor complication of brain tumor often was not recorded as a diagnosis and consequently a number of cases doubtless were overlooked in this survey. Of the 38 neoplasms, 15 arose within the cranial cavity and 23 outside it. Of the latter, 15 were lympho-epitheliomas from the nasopharynx.

Although abducens paralysis is fairly common in brain tumor, it is worth little as a localizing sign and, in general, can be accepted only as a warning that something is wrong. Extensive examinations and a prolonged period of observation may be necessary before identification of the cause becomes possible.

The sixth nerve may be paralyzed not only through direct involvement by a tumor but also as a consequence of increased intracranial pressure. One explanation is based on the observation that as pressure within the intracranial cavity increases the only large opening through which the contents may escape is the foramen magnum. The cerebellum drops down and its tonsils herniate into this opening. As the brain stem descends, it pulls the abducens nerve taut between its attachments at the lower margin of the pons and at the apex of the petrous pyramid of the temporal bone. Interruption of the nerve may occur as a result of stretching or as a result of pressure applied at the tip of the petrous pyramid where the nerve bends forward over the bony ridge.[1]

In the vascular subgroups, all 40 of the patients had hypertensive disease or senile arteriosclerosis. The nature of involvement of the nerve is speculative. Diabetes was present in 10 of the patients and may have been a contributory factor, possibly by inducing or intensifying vascular disease.

Aneurysms at the circle of Willis interrupt the sixth nerve far less frequently than they do the third. Only 11 such lesions occurred in this series and in most of these the diagnosis was based solely on clinical findings.

Inflammation of assorted types accounted for eight cases. Two were due to petrositis associated with mastoiditis, two occurred in children as a manifestation of encephalitis in poliomyelitis and four followed meningitis. Syphilis of the central nervous system appeared to be the basis for the abducens paralysis in seven cases.

Multiple sclerosis accounted for seven cases; there were seven others in which this disease was suspected but, since the evidence for it was equivocal, these have been classified as "undetermined."

Eleven cases were attributed to miscellaneous disorders; three of these followed injection of alcohol into or operation on the trigeminal nerve, two were associated with traumatic carotid-cavernous fistula, one each accompanied sinusitis, congenital heart disease, pseudotumor cerebri, and hydrocephalus, and two followed use of spinal anesthesia. Of the latter, one occurred in a 24-year-old woman a week after an operation on her uterus by her home physician. She consulted us a month later because of headache and diplopia, at which time her condition was improving. The other occurred in a 56-year-old man who underwent prostatic resection under spinal anesthesia; 10 days later, he complained of diplopia that was found to be due to partial paralysis of the right abducens nerve and paralysis of divergence, conditions which improved spontaneously during the succeeding weeks. This is the only case of abducens paresis we have been able to find that followed spinal anesthesia induced at the Mayo Clinic. Perhaps it really belongs in the vascular subgroup, for its basis is probably a small infarct in the pons.

TABLE 6

CAUSES OF PARALYSIS OF CRANIAL NERVES III AND IV

Cause	Cases
Undetermined	12
Head trauma	7
Neoplasm	6
Vascular	6
Aneurysm	9
Total	40

MULTIPLE CRANIAL NERVES

In combined paralysis of the third and fourth nerves, no single cause stands out as more important than the others (table 6).

A wide variety of disorders caused combined paralysis of the third and sixth nerves (table 7). Most of these cases presented difficult diagnostic problems. Among those in which the cause could be determined, trauma to the head was the most important factor. Neoplasms accounted for 10 cases; four of these lesions were meningiomas of the sphenoidal ridge.

We encountered no example of paralysis of the fourth and sixth nerves in which the third nerve was intact.

When all three nerves were involved (table 8), the disease process was widespread and the damage extensive. Neoplasms comprised the largest group, without predominance of any special variety. These tumors included adenomas of the pituitary, extension of malignant lesions from the nasopharynx, meningiomas, and metastatic lesions.

TABLE 7

CAUSES OF PARALYSIS OF CRANIAL NERVES III AND VI

Cause	Cases
Undetermined	18
Head trauma	12
Neoplasm	10
Vascular	3
Aneurysm	7
Inflammation	5
Syphilis	1
Other	4
Total	60

TABLE 8

CAUSES OF PARALYSIS OF CRANIAL NERVES III, IV AND VI

Cause	Cases
Undetermined	9
Head trauma	9
Neoplasm	12
Aneurysm	7
Other	9
Total	46

COMMENT AND SUMMARY

All the cases of acquired ocular paralysis in our study are listed in Table 9. The largest group by far comprised those of undetermined origin. Injury to the head accounted for the next largest number; more than half of these injuries were sustained in automobile accidents. Cerebral neoplasms caused diplopia more often by paralysis of the sixth nerve than by interruption of the third or fourth nerve. Occlusive vascular disease apparently accounted for many of the pareses. Aneurysm most often implicated the third nerve. When it did, with few exceptions, the pupils were affected. Syphilis was responsible for involvement of the third or sixth nerve in only 13 cases. It did not involve the fourth nerve in this series. Multiple sclerosis accounted for seven cases of paralysis of the sixth nerve. It was suspected in seven other cases, which we have included in the group of undetermined cause. We have no example in which it affected the third or fourth nerve. The other causes for the most part were inflammatory.

TABLE 9

CAUSES OF ACQUIRED OCULAR PARALYSIS

Cause	Cases
Undetermined	214
Head trauma	113
Neoplasm	86
Vascular	88
Aneurysm	80
Syphilis	13
Multiple sclerosis	7
Other	52
Total	653

The large proportion of cases in which the cause was undetermined is embarrassing but not altogether surprising. When isolated paralysis of a muscle of the eye is the first manifestation of a disease, determination of the cause may not be possible until other signs appear. The first examiner may not possess enough evidence to make a diagnosis. A later examiner may be aided by the passage of time and future developments.

Mayo Clinic.

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ATYPICAL ACCOMMODATIVE ESOTROPIA*

MARTIN J. URIST, M.D.
South Haven, Michigan

Since Donders' classical contribution to the theory of accommodative esotropia in 1864, little progress has been made until recently in our understanding of accommodative squint. The accepted classification has been that cases of esotropia that are corrected with plus lenses are cases of accommodative esotropia. The apparent mechanism of the squint is that patients with a high hypermetropic refraction have to accommodate in excess of their convergence in order to see clearly without glasses. The excess accommodation is linked reflexly with excess convergence and thus an esotropia develops. With the wearing of proper convex lenses, the need for excess accommodation is eliminated as is the corresponding accompanying excess convergence and thus the estropia is cured.

An important contribution to our knowledge of accommodative esotropia was made by Costenbader in 1948.[1] After analyzing his cases he was able to classify them into two types, typical and atypical accommodative esotropia. He defined typical accommodative estropia as follows:

"Persons having hypermetropia with obvious squint before wearing glasses but straight eyes for distance and near with glasses."

He defined atypical accommodative squint as "persons with low hypermetropia having straight eyes for distance both with and without correction but pronounced convergence for near vision both with and without correction."

Robinson[2] had this to say about atypical accommodative cases:

"There remain those cases in which although the appropriate glasses are prescribed and constantly worn, producing binocular single vision in the distance positions of gaze, overconvergence of the visual axis occurs when the patient looks with interest at an object close to him, usually when it is one meter from his face."

It is interesting to note that Costenbader reported 26 cases of typical and 25 cases of atypical in his series of accommodative squint, while Robinson reported 16 cases of fully accommodative and 48 cases of atypical accommodative squint. From these statistics it appears that the atypical cases are more common than the typical. In 1950, after further study of these atypical cases, Costenbader[3] classified them as accommodative esotropia, hypo-accommodative type. This was based on his finding that some of these patients had a remote near-point of accommodation. The esotropia, he felt, was due to the excessive stimulation of a weakened

* From the University of Illinois College of Medicine, Department of Ophthalmology, Illinois Eye and Ear Infirmary. Presented before the Chicago Ophthalmological Society, May 16, 1955.

TABLE 1

ANATOMIC RELATIONSHIPS IN CONCEPT OF DUAL MECHANISMS

	Supranuclear Centers	Nucleus	Nerves	Muscles
Near Mechanism	Convergence	III	Oculomotor	Medial rectus
	Near accommodation	Edinger-Westphal	Para-sympathetic	Circularciliary
	Miosis	Edinger-Westphal	Para-sympathetic	Sphincter pupil
Distance Mechanism	Divergence	VI	Abducens	Lateral rectus
	Distance accommodation	Ciliospinal	Sympathetic	Meridional ciliary
	Mydriasis	Ciliospinal	Sympathetic	Dilator pupil

accommodation mechanism which was apparent when reading. These were "juvenile presbyopes." In 1953[4] he reclassified these atypical cases into what he called "Esotropia —abnormal accommodation - convergence ratio type." These he defined as patients having a negligible refractive error, little or no esotropia at 20 feet, but a definite deviation at 13 inches on accommodation. He was able to alleviate the deviation with the proper bifocal lenses.

The findings in my series confirm those of Costenbader in that these cases apparently have an involvement of the near mechanism of vision without the distance being affected very much. I prefer to classify them as cases of accommodative esotropia for near. This is logical since there are other atypical accommodative cases that have findings in which the distance mechanism is primarily at fault with only slight or no involvement for near.

In 1952[5] I reported two cases, and since then have seen 18 cases, of accommodative esotropia that were unusual in that they had an esotropia for distance with straight eyes and stereopsis for near. Wearing the full correction for a large hypermetropia corrected the esotropia for distance and reduced the esophoria for near. Luhr and Schlossman,[6] in 1954, reported that in a series of 74 cases of intermittent and accommodative esotropia they found eight cases that were atypical in that the esotropia was greater for distance than for near. One case had 25 prism diopters of esotropia for distance and was orthophoric for near without glasses. With the full hypermetropia correction the esotropia for distance was corrected. After three years and three months of observation only four prism diopters of esophoria was present for distance with orthophoria for near.

My cases and those of Luhr and Schlossman can be classified as accommodative esotropia for distance. The occurrence of these two distinct types of accommodative esotropia showing a clear-cut specific involvement of near vision or distance vision must be of fundamental importance. It may be clinical evidence for the possibility that two distinct mechanisms for the control of the eyes exist; a near mechanism consisting of accommodation for near, convergence, and miosis, and a distance mechanism including accommodation for distance, divergence, and mydriasis.

Table 1 shows the anatomic relationships which might be affected if this dual-mechanism concept were correct.

The theory of a near mechanism has been well worked out and accepted by most authorities. As for the distance mechanism, the sympathetic innervation to the dilator of

the iris is a proven and accepted fact. The presence of a divergence center is still controversial, although recently Adler[7] has shown that active contraction of the lateral rectus muscles takes place in distance vision. More recently, work by Brecher et al.[8] on the effect of alcohol on vision seems to confirm the idea of a definite divergence mechanism separate from the convergence mechanism in binocular vergences.

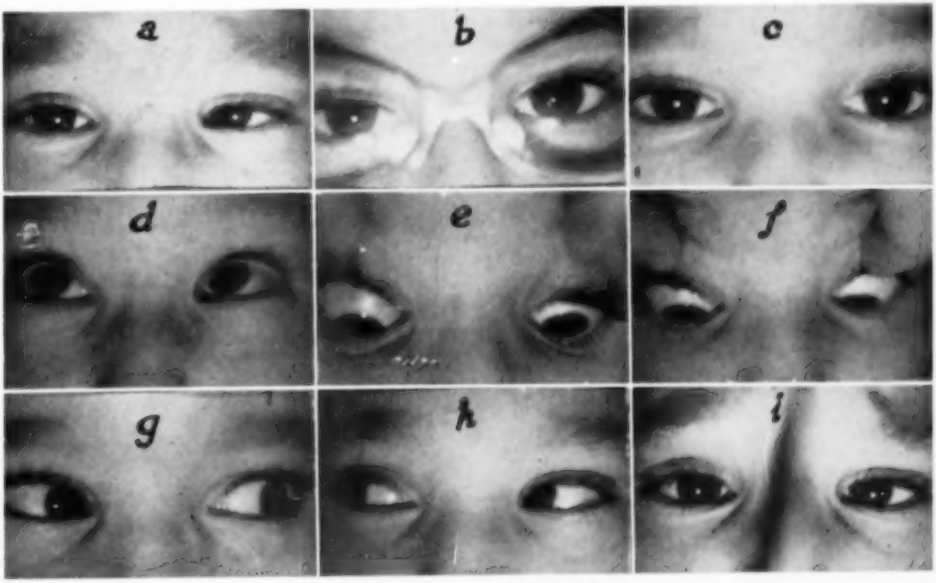
That accommodation for distance takes place through the sympathetic nerve and meridional ciliary muscle has not been completely proven and accepted. Duke-Elder,[9] in his chapter on the mechanism of accommodation, discusses thoroughly the evidence for a separate mechanism for distance accommodation. In summary, he says, "It would seem, therefore, that there is a case which merits the consideration that there is a mutually antagonistic activity in accommodation, a subsidiary sympathetic mechanism focusing for distant vision, and a dominant parasympathetic mechanism focusing for near vision.

Case reports

Case 1

Accommodative esotropia for distance, onset at eight years of age following an acute tonsillitis.

A. H., aged eight and one-half years, came to the infirmary on April 11, 1951, with a history of crossing of her eyes and double vision of two weeks' duration. These symptoms appeared following an acute tonsillitis with a high fever. The double vision was present for distance only. Before this her eyes had been normal in all respects and



Cover Measurements cgl. E 34, E'37.
sgl. ET 37, E'38.

ET36
ET38 Normal retinal correspondence with 2nd grade fusion.
ET20

Fig. 1 (Urist).

a. Twenty degrees of left esotropia for distance with homonymous diplopia.
b. Straight for distance with glasses; no diplopia.
c. Straight without glasses for near; can have 10 degrees of esotropia for near at times.
d. Twenty degrees of left esotropia in supraversion.
e. Ten to 15 degrees of exotropia looking down when eyes are straight for near.
f. Five to 10 degrees of left esotopia looking down when eyes are crossed for near.
g. and h. Eyes level on lateral gaze.
i. Near-point of convergence, 40 mm.

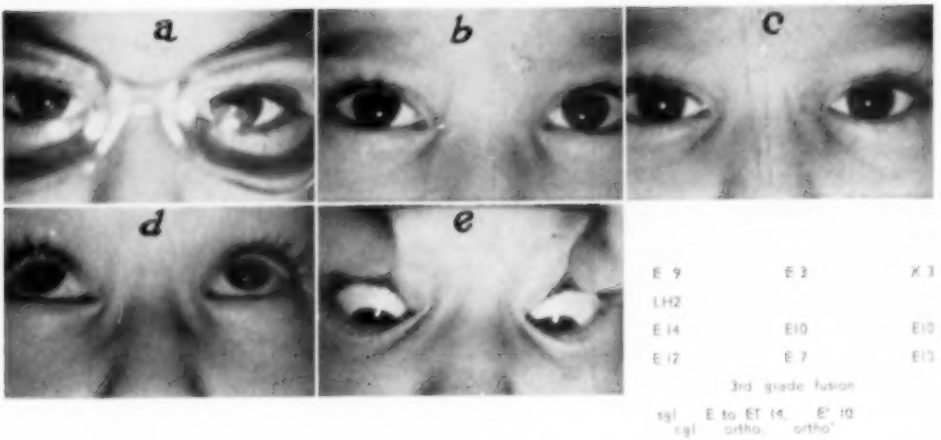


Fig. 2 (Urist).

a. Straight for distance and near with glasses.
b. Straight for distance without glasses.
c. Straight for near without glasses.
d. Straight in supraversion.
e. Straight in infraversion.

she had never worn glasses. There was no history of strabismus in the family. At the first examination she had 15 to 20 degrees of estropia for distance and 10 degrees for near.

An atropine refraction was immediately done with the following findings: O.D., +5.75D. sph. = 20/20; O.S., +6.5D. sph. = 20/20. Under atropine the eyes were straight. The full correction was prescribed to be worn all the time.

Examination, after having worn the glasses for one month (fig. 1), revealed that the eyes were straight for distance and near with glasses. Without glasses, there was 15 to 20 degrees of left esotropia for distance, with homonymous diplopia, and for near the eyes could be straight. On upward gaze there was 15 to 20 degrees of esotropia and looking down the squint varied from 10 degrees of esotropia to 15 degrees of exotropia. The eyes were level in lateral versions. The near-point of convergence was 40 mm. Cover measurements were:

cgl. E 34 prism diopters: E' 37 prism diopters.

sgl. ET 37 prism diopters: E' 38 prism diopters.*

Examination on July 28, 1954 (fig. 2), three years after the onset of the squint, revealed that the eyes were straight in all positions with and without glasses. Cover measurements were:

cgl. ortho distance and near.
sgl. E to ET 14 prism diopters: E' 10 prism diopters.

This child, for eight and one-half years of her life, had straight eyes and developed 20/20 vision in each eye without wearing any glasses even though she refracted a +5.75D. sph. in the right eye and a +6.5D. sph. in the left. She had no ocular complaints before the onset of her illness. She was able to dissociate a large amount of accommodation from convergence. The ability to dissociate had been so well developed that she could keep the eyes straight for near most of the time even though a large esotropia suddenly developed for distance. In her case and in others, I have noticed that the inhibition or dissociation of convergence necessary to keep the eyes straight for near, apparently could affect the position of the eyes in infraversion. When it required a large amount of inhibition of convergence and relaxation of the medial recti to keep the eyes straight for near, an exotropia was seen on downward gaze (fig. 1-e). When the eyes were not straight for near, and therefore little relaxation of the medial

* In his discussion of this paper, Dr. Daniel Snydacker asked why these cases couldn't be classified as divergence insufficiency cases since they had all the necessary findings. In my experience,[6] pathologic processes anywhere along the distance mechanism of vision, whether supranuclear or peripheral in the muscles themselves, may result in symptoms consistent with a diagnosis under the generic term of divergence insufficiency. The classification of some cases into accommodative esotropia for distance is an attempt to localize the pathologic changes more specifically for better understanding and treatment.

recti was required, an esotropia was present on looking down (fig. 1-f).

How the acute illness caused the esotropia was not known. We do know that the distance mechanism was the one most severely affected since the eyes were always crossed for distance with diplopia while they were straight for near most of the time with no double vision. A large accommodative component was present since the glasses completely corrected the esotropia.

CASE 2

Accommodative estropia for distance since birth, well controlled with glasses which were prescribed at the age of three years.

S. N., aged 14 years, came to the infirmary on June 2, 1941, with a history of the eyes crossing for distance at times. This condition had been present since birth. She had been wearing glasses since the age of three years. With atropine cycloplegia, refraction was: O.D., +3.75D. sph. ⌒ +1.5D. cyl. ax. 90° = 20/20; O.S., +3.5D. sph. ⌒ +1.0D. cyl. ax. 100° = 20/20.

Examination revealed (fig. 3) the eyes could be straight for distance and near with and without glasses. At times there wold be 20 degrees of esotropia for distance without glasses. The eyes usually remained straight for near. About 25 degrees of esotropia were present on upward gaze and about 10 degrees of exotropia on downward gaze. There was marked depression in adduction and the near-point of convergence was 40 mm. Third-grade fusion was found on the Synoptophore. There was slanting of the palpebral fissures up and out. Cover measurements were as follows:

cgl. E 15 prism diopters, E′ 15 prism diopters.
sgl. ET 26 prism diopters, E′ 20 prism diopters.

I believe that the pathologic change in this case was a congenital involvement of the distance mechanism. This fortunately did not prevent the near mechanism from developing normally and resulted in the eyes being straight for near and allowing fusion and vision to develop well. Glasses given at the age of three years helped the accommodative component for distance.

In this case and in many others, when marked depression in adduction was present, there appeared to be an associated obliquity of the palpebral fissures. The lateral canthi were higher relative to the medial canthi causing the palpebral fissures to have a characteristic slant up and out.

The following case is interesting in that she demonstrated a difference in the palpebral fissures between the two eyes.

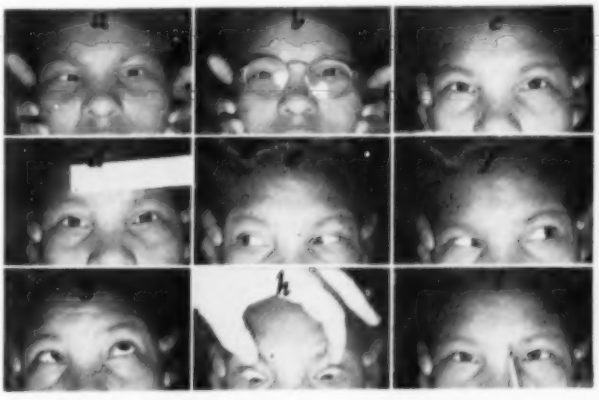
CASE 3

J. L., aged 28 years, was operated on for an esotropia of the left eye at the age of eight years. Immediately after surgery the left eye turned up and out and stayed there. The vision in the right eye was 20/15 and in the left eye 1/200. The constant position of the left eye up and out for 20 years apparently has made the left palpebral fissure slightly more elevated than the right palpebral fissure (fig. 4-a, b, c).

In Figure 4-d, e, and f, the opposite condition of slanting of the palpebral fissure down and out, found in cases of bilateral elevation in adduction,

Fig. 3 (Urist).

a. Twenty degrees of right esotropia without glasses for distance.
b. Straight for distance with glasses.
c. Straight for near without glasses. Note slanting palpebral fissures in which the outer canthus slants up and out in all poses.
d. Can be straight for distance without glasses for a short time.
e. and f. Bilateral depression in adduction.
g. Twenty-five degrees of right esotropia looking up.
h. Five to 10 degrees of exotropia looking down.
i. Near-point of convergence is 40 mm.



ET 42	ET40	ET37	Cover measurements:
RH 4			cgl. E 15; E′ 15.
ET 23	E 20	ET27	sgl. ET26; E′ 20.
RH 4			
RH 4	0	E 2	Stereoptis

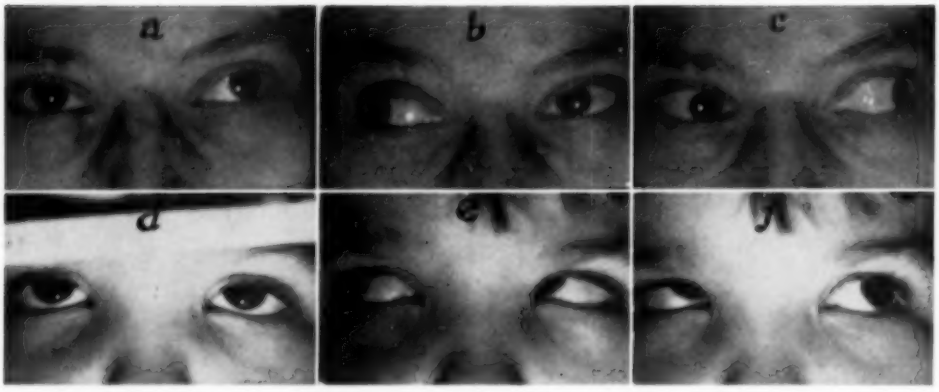


Fig. 4 (Urist).

a. Twenty degrees of left exotropia. Left external canthus is higher than the right by measurement. (Not shown too well on photographs.)

b. and c. Looking to the right and left brings out the difference in the up and outward slant of the palpebral fissure on the two sides. The left side takes a greater slant in an upward direction than does the right palpebral fissure.

d. Straight for distance. Slight slant of the palpebral fissures down and out.

e. and f. Marked bilateral elevation in adduction.

can be seen. Since this paper was written, Urrets-Zavalia[19] has described the same condition. He describes the slant found in cases of bilateral depression in adduction as Mongoloid and that found in cases of bilateral elevation in adduction as anti-Mongoloid. He considers these deformities to be developmental in character.

CASE 4

Accommodative esotropia for near, onset at six months of age.

D. S., aged seven years, came to the infirmary on December 29, 1948, with a history of the left eye crossing at times since six months of age. This was present mostly when she looked at something close, especially a double decker ice-cream cone. She had been wearing glasses since three years of age which had kept the eyes straight most of the time.

Examination revealed that the eyes were straight for distance and near with the following corection: O.D., +1.25D. sph. $\bigcirc$ +0.5D. cyl. ax. 90° = 20/20; O.S., +1.5D. sph. $\bigcirc$ +0.5D. cyl. ax. 90° = 20/20. However, when she looked at something close the left eye turned in with glasses about 15 degrees. Without glasses about 10 to 15 degrees of esotropia was present for distance and for near. She had third-grade fusion with glasses.

At periodic examinations in the clinic her eyes were observed to be getting straight with a light both with and without glasses, for near as well as for distance. But, when she read, the left eye would turn in. This, however, has been improving. She wears glasses only for reading now. At the last examination on May 21, 1954 (fig. 5), the eyes were straight for distance and near without glasses. There was 25 degrees of left esotropia when she was asked to read some fine print without glasses. With the glasses her eyes could be straight for reading a good deal of the time.

I have been following this patient in the motility clinic since 1948. When first seen the eyes were straight for distance and near with glasses and the patient had stereopsis. Without glasses she had 10 to 15 degrees of esotropia for distance and near. From these findings this would appear to be a typical case of accommodative esotropia. However certain findings were unusual, namely, the onset at six months of age, and the complete control of the esotropia with only a +1.25D. sph. $\bigcirc$ +0.5D. cyl. ax. 90°, O.U.

Close study and many follow-ups in the clinic finally revealed the true picture of accommodative esotropia for near. Even though the eyes were badly crossed in the clinic the mother insisted that the eyes were straight without glasses at home, and only when she concentrated on something close was a squint visible. This we found to be true as the child became accustomed to the clinic.

The most interesting findings and, I believe, those with the most diagnostic significance in this case were the straight eyes and orthophoria measurements with and without glasses for distance and near and the third-grade fusion. Yet when she read, 25 degrees of esotropia was uncovered. In other similar cases I have made the error of reducing the plus correction too much because the patient was examined with a light only and there

was a recurrence of the esotropia. Now I routinely check all my accommodative cases for reading with and without glasses before reducing the correction. Parks[8] stressed this when he insisted that the relative fusion divergence amplitude be taken. This meant that before the patient was examined with the cover test he had to be made to accommodate for near by looking at a letter with 20/30 clarity instead of at a light. This method will bring out the near esotropia.

I did not put a reading add on this patient because she is in my control series. This patient has shown progressive improvement so that at the last examination in May, 1954, at the age of 13 years, the eyes could be straight with glasses for reading a good deal of the time.

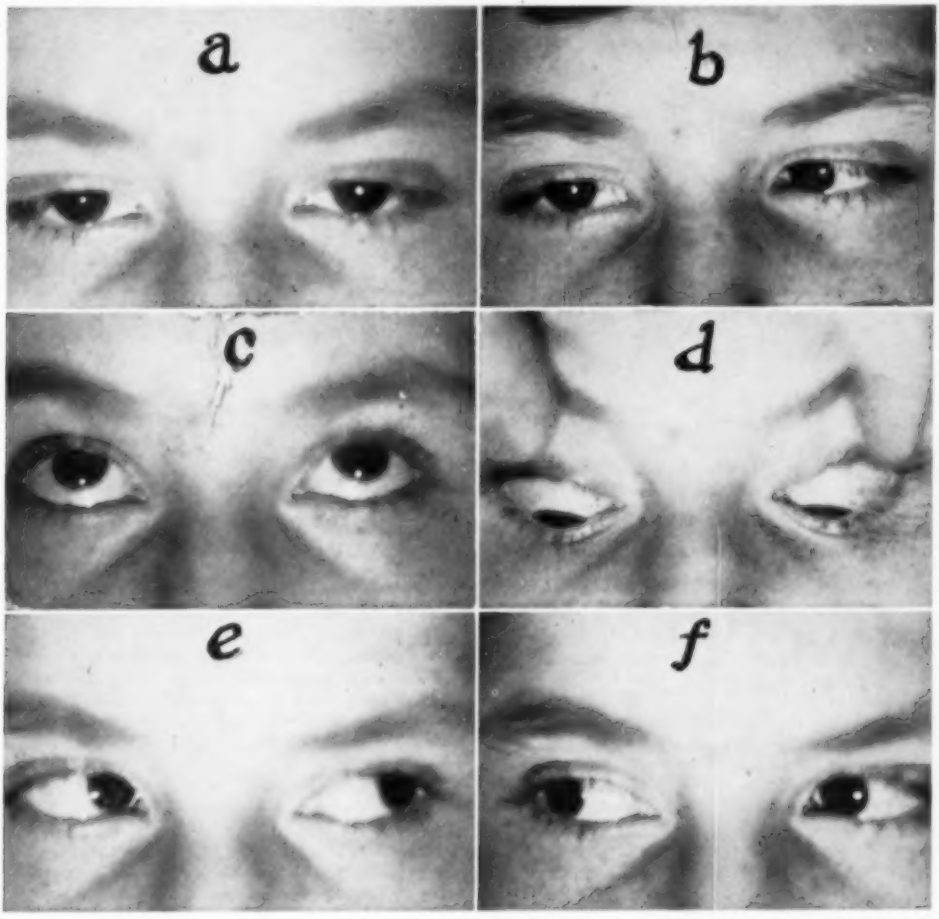


Fig. 5 (Urist).

a. Straight to a light for near and also for distance, without glasses. Orthophoria.
b. Twenty-five degrees of left esotropia when reading.
c. Eyes straight looking up.
d. Five degrees of left esotropia looking down.
e. and f. Eyes level on lateral gaze.

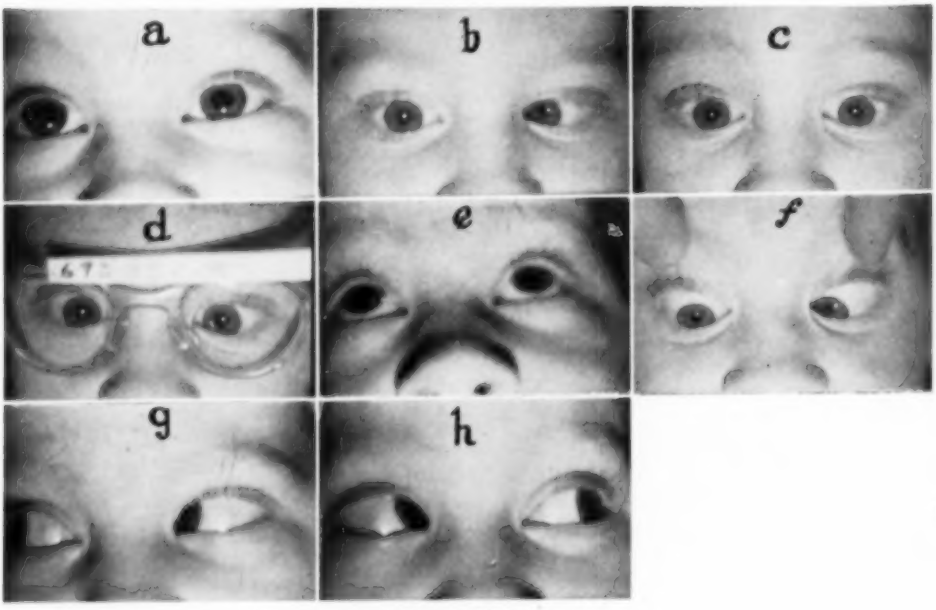


Fig. 6 (Urist).

a. Eyes straight for distance without glasses. Patient looking over camera.
b. Twenty degrees of left esotropia when reading.
c. Can be straight to a light for near.
d. Fifteen degrees of left esotropia with glasses when reading.
e. Straight looking up.
f. Twenty-five degrees of left esotropia looking down.
g. and h. Bilateral elevation in adduction.

CASE 5

Accommodative esotropia for near, onset at birth.

L. M., aged two months, was brought to the infirmary in June, 1948, with a history of the left eye turning in at times since birth. On examination the eyes were found to be straight to the light. This baby had moderate sized epicanthal folds and I told the parents that this was a pseudosquint. The child was brought back at the age of six months and the mother stated that the left eye definitely turned in at times. I examined this patient again and again found the eyes were straight to a light and with the cover test. Again I informed the parents the child had no squint. However, the mother said she would show me how it crossed and produced the nursing bottle. When the bottle was held close to the child and the child looked at it, the left eye turned in 25 degrees. This was a near esotropia.

The child was followed in the clinic at three-month intervals and at subsequent examinations the eyes remained straight for distance but began to cross more frequently for near so that at the age of two years, when she looked at a light for near, there was 15 degrees of esotropia.

Refraction with atropine cycloplegia was: O.D., +0.5D. cyl. ax. 180°; O.S., +1.5D. cyl. ax. 180°.

At the age of three years vision was 20/40 in each eye. Since the child was an avid colorer and picture book reader the following glasses were prescribed for close work, instead of bifocals: O.D., +2.0D. sph. ⊃ +0.5D. cyl. ax. 180°; O.S., +2.0D. sph. ⊃ +1.5D. cyl. ax. 180°.

At the last examination in August, 1954, when the child was six years old, the vision was 20/30 in the right eye and 20/50 in the left. The eyes were crossed for near most of the time, at least in the clinic, with and without glasses. An esotropia could also be seen for distance once in a while.

Following this case almost from birth has been very instructive which is my reason for presenting it. The mother taught me how to test an infant for near esotropia. No cause for the squint could be found. The only significant fact was that the mother's sister's child had had the same sort of squint and outgrew it. Since I have been following this patient she certainly has not been outgrowing the squint—it has been getting worse. Her eyes were straight for distance and now an esotropia for distance is apparent much of the time. She has developed an amblyopia in the left eye, an indica-

TABLE 2

COMPARISON OF NEAR AND DISTANCE ACCOMMODATIVE ESOTROPIA

	Near Accommodative Esotropia	Distance Accommodative Esotropia
Distance	Straight with or without glasses	Esotropia without glasses, straight with glasses
Near	Usually esotropia with or without glasses, always when reading	Straight with or without glasses, straight for reading
Accommodation	Affected for near	Affected for distance*
Fusion	Present for distance	Present for near
Sursumversion	Straight	Marked esotropia
Deorsumversion	Marked esotropia	Straight or exotropia
Lateral versions	Elevation in adduction	Depression in adduction
Obliquity of palpebral fissure	Down and out	Up and out
Treatment	Plus add for near	Minus add for near*
	Cholingeric drugs	Sympathomimetic drugs*
	Recession of medial rectus	Resection of lateral rectus

* Theoretical possibilities.

tion that she is losing binocular vision and developing suppression. It appears that the original near deformity is beginning to affect the distance mechanism.

On March 21, 1955, bifocals with the following prescription were given: O.D., +0.25D. sph. $\bigcirc$ +0.25D. cyl. ax. 180°; O.S., +1.0D. cyl. ax. 180°; O.U., add +3.0D. sph. for reading. Examination on May 16, 1955, after wearing the bifocals for three months, revealed the eyes to be much straighter. They could be straight for distance all of the time and for near a good deal of the time.

The pathologic process in this case was probably a congenital involvement of the near mechanism.

In Table 2 a comparison of the findings in near and distance accommodative esotropia is shown.

SUMMARY

1. Certain cases of atypical accommodative esotropia could be classified into accommodative esotropia for near and others into accommodative esotropia for distance.

2. This classification seems logical because there is such a clear-cut separation in the clinical findings. In one type, the near position was grossly affected, with little involvement of the distance. In the other, the distance was affected, with little trouble for near.

3. The occurrence of such a sharp separation in the involvement of near and distance vision may be clinical evidence in support of the concept of a dual innervational mechanism for control of the eyes—a near mechanism of convergence, near accommodation, and miosis, and a distance mechanism of divergence, accommodation for distance, and mydriasis.

432½ Phoenix Street.

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PERIPHERAL IRIDECTOMY

With retention of the anterior chamber

Otto Barkan, M.D.
San Francisco, California

Iridectomy performed with the usual incisions is accompanied by loss of the anterior chamber and its reformation may be delayed. Graefe[1] observed that cases in which the anterior chamber was slow to reform were the least successful in reduction of pressure. Adhesions form in the angle as the result of leakage and defeat the purpose of the operation.[2, 4, 9, 14] Nevertheless, little attention has been paid to the possible deleterious effect of loss or delayed reformation of the chamber on the outcome of iridectomy and few attempts have been made to prevent leakage.[1–7]

The main action of iridectomy in narrow-angle (angle-closure or closed-angle) glaucoma consists of equalizing the pressure in front of and behind the iris, collapsing the iris bombé, widening or opening the angle, and exposing the trabecula to aqueous throughout the circumference.[2–9] A secondary action is the posterior displacement of the lens and the increase in the axial chamber depth.[2, 3, 8, 9] By by-passing the secluded pupil and equalizing the pressure in front of and behind the iris, iridectomy breaks the vicious cycle of narrow-angle (angle-closure) glaucoma, reverses the process, and restores physiologic conditions. Since this action can take place adequately only in a sealed chamber, loss of the chamber or leakage from the wound interferes with the action of iridectomy, as well as promoting the formation of postoperative adhesions in the angle.

In order to encourage the action of iridectomy and prevent postoperative adhesions, in 1938 I suggested a technique which employed an oblique trap-door corneal incision and encouraged immediate reformation of the chamber.[2, 13] The importance of preventing postoperative leakage and peripheral adhesions was emphasized.

This method was later replaced by the easier ab externo method with scleral scratch incision. However, with this incision aqueous is lost at the time of operation, and, as noted by Spaeth,[12] the chamber is frequently abolished for several days and re-establishes itself more slowly than with the classic keratome section. Attempts to prevent loss of aqueous or leakage were made on over 100 cases of narrow-angle (angle-closure) glaucoma. Prelaid scleral sutures and various incisions were inadequate as shown by application of fluorescein to the incision and by the frequent shallowness of the whole or the periphery of the chamber for several hours or days. Haas and Scheie[7] and Chandler[5] also closed the scleral incision with a prelaid catgut suture to prevent leakage.

The usual ab externo incisions are placed 1.5 to 2.0 mm. or further back of the limbus. They are often bevelled toward the angle of the anterior chamber and made 2.0 to 3.0 mm. long where they enter the chamber in

order to admit small iris forceps. But incisions of this size encourage loss of chamber, leakage, and the formation of pupillary adhesions, necessitating the postoperative use of mydriatics which in turn encourage peripheral adhesions. A bevel discourages prolapse of the iris making it necessary to enter the anterior chamber with forceps. It may also encourage incarceration of iris as noted by Meller and Böck,[11] whereas a small vertical incision, by virtue of the right-angled edges of its inner wound, discourages entanglement of the iris.

I have modified my technique of iridectomy ab externo, recently published,[4] with the particular purpose of retaining the chamber at the time of operation as well as preventing later leakage from the wound. This objective is accomplished by making the incision vertical to the sclera, 1.25 mm. posterior to the corneoscleral border in the 10:30- or 1:30-o'clock meridian and *no longer than one mm. where it enters the anterior chamber*. Prolapse of the iris, if not spontaneous, is produced by traction on the wound margins by means of prelaid black silk sutures. When the extremely small opening is made in this position it becomes plugged with iris before aqueous can escape, and the chamber is retained. The necessity of entering the wound with forceps is eliminated. Because of the small size of the incision operative risks are reduced, there is no postoperative astigmatism, and vision is not disturbed. The technique is therefore particularly adapted to early and prophylactic operation. It has advantages also in the congestive stage and acute attack. Retention of the anterior chamber may help to discourage the development of malignant glaucoma.

Technique

This technique differs from that published in 1954[3,4] in some details which are of critical importance to the consistent success and safety of the operation.

The usual preliminary measures are used, including a bridle suture of the superior rectus tendon. The pupil should be miotic. Ophthaine local anesthesia without retrobulbar injection and intravenous Demerol are given.

The surgeon operates from behind the head. The assistant stands on the temporal side of the eye to be operated upon. The conjunctiva is raised with an injection of Xylocaine. The conjunctiva and Tenon's capsule are incised six mm. above the limbus. The flap is reflected over the cornea. A scratch incision is made vertical to the sclera 1.25 mm. posterior to the corneoscleral border in the 10:30- or 1:30-o'clock meridian (1.5 mm. in the 12-o'clock meridian). This is conveniently measured by placing a spatula 1.25 mm. wide under the conjunctival flap in contact with the attachment of the conjunctiva to the cornea, for example, at the corneoscleral border.

The scratch incision of the superficial layers of the sclera should be vertical, made at first with the edge of a sharp keratome. The superficial scleral incision should be five mm. long to provide ample exposure of the deeper scleral and corneal layer.

When the incision has penetrated over one-half the thickness of the scleral layer, a 6-0 double armed suture is laid, making sure that a thick bite of sclera is obtained extending almost to the corneal layer. Too thin a bite results in displacement rather than retraction and opening of the wound. One needle is passed through the corresponding point of the conjunctival flap. The second needle is not continued through the conjunctival flap until after the completion of the operation.

The assistant retracts the sutures with two Castroviejo suture forceps, which are of sufficient length not to interfere with the field of operation or illumination. He retracts a little during the making of the deep scleral incision, but avoids excessive retraction which disturbs topography. Hemorrhage should be stopped with cautery. The area must be kept dry for perfect visibility. A magnifying head loupe is used.

When the incision reaches the corneal layer, it is controlled by scratching its central portion with the tip of the keratome while under full visibility. The angle between shaft and blade removes the shaft from the field of vision. If a Bard-Parker or Lundsgaard knife is used it fills the incision as it cuts so that the entry into the anterior chamber cannot be observed. The region is kept dry with the slender tip of an applicator held in the left hand.

If the incision, where it enters the chamber (passing through the last layers of transparent corneal tissue) is not longer than one mm., the fluid in the posterior chamber consistently forces the iris into the wound, plugging it, before aqueous can escape from the anterior chamber. The prolapse of basal iris is ensured, in spite of the small size of the opening, by the position of the opening in the recess of the angle and by the verticality of the wound combined with retraction of the wound margins by the prelaid sutures. If the iris does not present sufficiently to be grasped by forceps, it can be made to present by retracting the wound margins with the sutures or by carefully enlarging the edge of the corneal wound with the tip of the keratome. Pressure on the globe should be avoided since this is not as easily controlled as traction for enlarging the wound.

After the prolapse has been grasped at its base, with a delicate Grieshaber double-angle iridectomy forceps, the tension on the sutures is released.

If the traction on the sutures is not discontinued before the iridectomy is performed the chamber will be lost through the wound which is being held open.

The assistant keeps conjunctiva and sutures out of the way. The root of the iris is stretched to either side before cutting (in two cuts with a small Barraquer iris scissors) in order that when it snaps back, the coloboma may extend beyond the inner wound.[3] This discourages adhesions and assures basality of the coloboma. If a pillar of iris should nevertheless remain in contact with the inner wound it can be released by a few sharp taps on the outside of the cornea with the blunt end of an instrument or with a glass rod. The verticality of the incision with its right-angled margins facilitates this maneuver.

The prelaid scleral suture is passed back through the conjunctival flap and tied. Cortisone (1.5 percent) is instilled at the completion of the operation and during convalescence.

Discussion

This manner of making the ab externo sclerocorneal incision and the iridectomy assures retention of the anterior chamber at the time of operation and thereafter. Because of the tiny size of the corneal aperture and the greater size of the coloboma, there is little tendency for entanglement of the iris in the wound and there has been no need of entering the chamber with an instrument.

The pupil retains normal mobility and reactivity to light, showing that the chamber retaining technique minimizes postoperative irritability of the iris. Thus postoperative adhesions are eliminated, and mydriatics (which encourage peripheral adhesions) and miotics (which promote pupillary adhesions) can usually be dispensed with.

If at the time of the first or second dressing, marked miosis (1.5 mm.) is still present and reactivity of the pupil to light has not been restored, a mild mydriatic such as adrenalin (1-100) or euphthalmine (two percent) may be installed in order to prevent pigment being deposited on the anterior capsule of the lens while the pupil is in extreme miosis, but this is rarely necessary.

I believe that the principle of retention of the anterior chamber is important and should be adhered to whenever possible.

In the last year over 20 operations have been successfully performed on early cases with the modified technique which ensures retention of the anterior chamber. Two illustrative case histories are presented:

Case reports

Case 1

Mrs. B. H., aged 36 years, had recently suffered from headaches while watching motion pictures. Her ophthalmologist noted that the anterior chambers were shallow. Tension was normal but the dark-room test produced elevated tension in the right eye. When first seen on November 3, 1953, vision and visual fields were normal, the axial anterior-chamber depth measured with the Ulbrich drum was 1.5 mm. each eye (normal according to this method 2.0 mm.); corneal diameters were 10.75 as compared to the 11.5 mm. which is average for the normal eye.

The refractive error was: R.E., +2.0D. sph. $\bigcirc$ +0.5D. cyl. ax. 170°; L.E., +2.0D. sph. $\bigcirc$ +0.5 D. cyl. ax. 30°. Tension was: R.E., 18 mm. Hg; L.E., 10 mm. Hg (Schiøtz), the last drop of pilocarpine having been instilled two and one-half days previously. Following a one hour dark-room test, tension was: R.E., 37 mm. Hg; L.E., 27 mm. Hg (Schiøtz). Gonioscopy showed a typical narrow-angle with bombé of the iris, O.U., which increased following the dark-room test. On the right eye the area of angle closure, which previously had extended from the 11- to 1-o'clock positions, after the dark-room test included the whole upper half of the circumference. The narrowness in the lower half had increased. The diagnosis was made of narrow-angle glaucoma (iris-block or angle-closure) with shallow axial anterior chamber depth and small corneas. The patient preferred to undergo a prophylactic operation rather than to continue the use of miotics and face an ultimate operation in the future when conditions would probably not be as favorable.

On November 24, 1953, peripheral iridectomy ab externo with the chamber retaining technique was performed on the right eye, the incision where it entered the chamber being not larger than 1.0 mm. On December 10, 16 days postoperative, the anterior chamber depth measured right 2.0 mm., left 1.5 mm. A slight amount of the difference in anterior chamber depth, but not more than 0.1 or 0.2 mm., might have been accounted for by the difference in pupillary size which was right 2.75 mm., left 1.5 mm.

On April 27, 1954, peripheral iridectomy ab externo with the chamber-retaining technique was performed on the left eye under local anesthesia with an intravenous injection of Demerol, 100 mg. On June 7, 1955, tension was: R.E., 18 mm. Hg; L.E., 15 mm. Hg (Schiøtz) without drops. After one hour in the dark-room tension was: R.E., 23 mm. Hg; L.E., 18 mm. Hg (Schiøtz). The refractive error was practically unchanged, being: R.E., +2.0D. sph. $\bigcirc$ +0.75D. cyl. ax. 170°; L.E., +2.0D. sph. $\bigcirc$ +0.5D. cyl. ax. 180° = 10/10 each eye. Axial anterior chamber depth measured 1.8 mm. in each eye.

Summary. Postoperative gonioscopy showed the bombé of the iris collapsed and the angle open throughout the circumference so that the trabecula, which was of normal appearance, was exposed to aqueous. The refractive error was practically unchanged. The patient is not using miotics. The provocative dark-room test became negative, the axial anterior chamber depths increased from 1.5 to 1.8 mm. which is average or normal. It may be presumed that this deepening represents a return from an acquired shallowness of the chamber to the original depth before the glaucomatous process began.

Case 2

Mr. H. L. B., aged 58 years, was first seen on October 2, 1952. One and a half years previously his local ophthalmologist had found the intraocular pressure increased in both eyes and prescribed pilocarpine (0.5 percent, three times daily). Recently, in the evening he had seen haloes. His mother, who is 88 years old, became blind at the age of 63 years following operations for congestive attacks of glaucoma. A cousin also had been operated on for glaucoma.

The patient's visual acuity and fields were normal. The optic discs showed, as is often the case in narrow-angle glaucoma, the physiologic excavation to be almost absent. The axial chamber depth was 1.5 mm., O.U., compared to the normal of 2.0 mm. (Ulbrich's drum). The corneal diameters in the horizontal meridian measured with calipers were 10.25 mm. compared to the average of 11.5 mm. Gonioscopy showed bombé appearance of the iris which is characteristic of narrow-angle glaucoma (angle-closure). The angle was very narrow throughout the circumference but especially above the cleft between the bombé of the iris and the ring of Schwalbe could barely be distinguished. The appearance of the trabecula in so far as it was visible was normal. The tension was: R.E., 28 mm. Hg; L.E., 22 mm. Hg (Schiøtz) two hours after the last drop of pilocarpine (0.5 percent).

The patient was advised to continue with pilocarpine (0.5 percent, every four hours). It was explained to him that, if symptoms should arise or if the strength of the miotics should have to be increased, an early or prophylactic peripheral iridectomy ab externo with a chamber-retaining technique should be considered.

The patient returned two years later complaining of occasional slight foggy vision. The tension was: R.E., 30 mm. Hg; L.E., 32 mm. Hg (Schiøtz), the last drop of miotic having been instilled four hours previously. Pilocarpine had been increased to two percent, four times a day, to control the tension. After stopping miotics for 24 hours, the tension increased to: R.E., 50 mm. Hg; L.E., 42 mm. Hg (Schiøtz). Gonioscopy showed essentially the same findings as two years previously, namely, a marked bombé of the iris, right more than left, but in the right eye the area of angle closure in the upper circumference appeared more extensive.

On October 5, 1954, peripheral iridectomy ab externo with the chamber-retaining technique was

performed on the right eye, under local anesthesia and 50 mg. of Demerol intravenously. On October 8, 1954, the same operation was performed on the left eye. When last seen on July 15, 1955, the axial anterior chamber depth had increased from the preoperative 1.5 mm. to 2.0 mm. in both eyes. Tension without miotics was: R.E., 20 mm. Hg; L.E., 18 mm. Hg (Schiøtz) unchanged after one hour in a dark-room. Vision with correction was 10/10 in each eye. There was practically no change in the refractive error following surgery as shown by the following comparison:

Preoperative: R.E., −0.25D. sph. ⌒ +0.5D. cyl. ax. 90°; L.E., +0.62D. cyl ax. 85°. Postoperative: R.E., −0.25D. sph. ⌒ +0.5D. cyl. ax. 85°; L.E., +0.62D. cyl. ax. 120°.

Summary. Postoperative gonioscopy shows the bombé of the iris collapsed and the angle widened, exposing the normal appearing trabecula to aqueous. The axial anterior chamber depth was deepened. The glaucomatous process was reversed and the pressure normalized.

Statistics of iridectomy

Statistics relating to iridectomy have in the past been confusing and relatively valueless because the technique of operation and the indications for iridectomy have not been clearly defined. In the absence of gonioscopy and of a pathogenic classification cases of simple (open-angle) glaucoma in which iridectomy serves no purpose, were sometimes included. In narrow-angle (angle-closure) glaucoma the presence of preoperative adhesions or previous damage to the trabecula frequently invalidated the effect of the operations. In cases without adhesions and with the trabecula intact where the indications for iridectomy were valid, loss of the anterior chamber with delayed reformation and ensuing postoperative adhesions frequently led to poor results.

For a comprehensive comparison and clarification of results, iridectomy performed on different types and in different stages of the same type of glaucoma should be separated in statistical reports. Modern methods of diagnosis, including gonioscopy, make this possible. Only in this way can a valid comparison be made between different techniques of iridectomy and between iridectomy and other operations.

Summary

A modified technique for iridectomy in narrow-angle (angle-closure) glaucoma is presented which ensures retention of the chamber at operation and prevents later leakage from the wound. Such a technique possesses important advantages.

1. The angle remains open discouraging the formation of postoperative peripheral adhesions.

2. Postoperative irritability of the iris is minimized as shown by the normal mobility and reactivity of the pupil to light, thus further discouraging adhesions.

3. The postoperative use of mydriatics and miotics which encourage adhesions in the angle and/or in the pupil can be dispensed with.

4. The technique is remarkably atraumatic. The escape of aqueous and associated positional changes of intraocular parts are avoided.

5. Retention of the chamber encourages the specific action of iridectomy. This consists of by-passing the secluded pupil, collapsing the bombé of the iris, widening the angle, exposing the trabecula to aqueous, and deepening the axial chamber.

6. When performed before peripheral adhesions have formed or the permeability of the trabecula has been impaired by temporary closure of the angle, it breaks the vicious circle and reverses the narrow-angle (iris-block or angle-closure) process. This applies to the acute attacks as well as to the subacute, chronic congestive, and noncongestive or prodromal phases of narrow-angle (angle-closure) glaucoma.

7. Retention of the chamber, by preventing forward propulsion of the lens-iris diaphragm, may be hoped to discourage the development of a malignant course.

This technique improves the results of peripheral iridectomy in narrow-angle (angle-closure) glaucoma when performed before peripheral adhesions have formed. It

permits early and prophylactic operation with safety. It does not disturb vision because the small incision produces no astigmatism. It reverses the morbid process, restores physiologic conditions, and assures a permanent clinical cure.

490 Post Street (2).

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OPHTHALMIC ULTRAVIOLET ACTION SPECTRA*

A. Bachem, Ph.D.
Chicago, Illinois

Introduction

Several recent publications, dealing with various effects of ultraviolet rays of different wavelengths upon the eyes, call for a critical discussion and further experimentation.

A. Coblentz,[1] to justify the use of the middle ultraviolet (from 280 to 290 mμ to 310mμ) for home-model "sunlamps," in spite of the proof that excessive application of these rays may produce epithelioma,[2,3] now calls attention to the production of "keratitis and conjunctivitis by radiation of wavelengths shorter than 2,800 angstroms" (280 mμ). He even warns[4] that "ultraviolet radiation of wavelengths shorter than 2,900 angstroms . . . are dangerous because they produce conjunctivitis and, with excessive exposures, may cause coagulation of albumen (cataract)."

These arguments require corrections from several points of view:

1. According to the careful studies of Cogan and Kinsey[5] the maximal keratic effect occurs above 280 mμ, that is, at 288 mμ. The effect fades out toward the longer ultraviolet (above 310 mμ) and toward the short ultraviolet (around 254 mμ).

2. Coblentz does not realize that all ultraviolet rays below 293 mμ are completely absorbed by the human cornea and cannot have any direct effect upon the lens. An indirect

* From the Department of Physiology, University of Illinois College of Medicine. This study was supported by a grant from the Graduate School of the University of Illinois.

effect of corneal injury upon the lens metabolism has not been observed and appears highly improbable.

3. Coblentz discards the possibility that ultraviolet rays of wavelengths 293 to 400 mμ, passing through the cornea and absorbed and scattered through the lens, may produce cataract, either directly through metabolic changes in the lens or indirectly[6] through uveal injuries and subsequent interference with the nutrition of the lens.

4. Coblentz also overlooks the fact that the corneal and conjunctival responses are harmless inflammatory and pain reactions which protect the eyes against repeated ultraviolet exposures by closing the eyes or wearing spectacles, with the result of prevention of corneal ulcers or cataract.

B. Cogan[7] states: "It has been estimated that the amount of ultraviolet radiation necessary to produce a threshold response in the lens will be three times that required for a threshold response in the cornea."

This remark refers to Kinsey's[8] calculation and holds only for the ultraviolet rays of sunlight. A postulation of a constant threshold ratio for lens and cornea throughout the ultraviolet spectrum is illusory from the points of view that rays of 288 mμ which affect the cornea maximally do not reach the lens and cannot affect it; and that near ultraviolet rays, penetrating the cornea and strongly absorbed in the lens, may exert a relatively greater effect upon the lens (particularly in the guinea pig and possibly more in man than in the rabbit).

Furthermore Cogan concludes that "the cataractogenic properties of ultraviolet rays have little practical consequence." Here the author overlooks the fact that cataract is a late response with a cumulative tendency while threshold keratitis and conjunctivitis and reversible blurring of the lens surface represent immediate responses to single doses. Thus repetitive ultraviolet exposures, though subthreshold for cornea and conjunctiva, may well lead to cataract in the long run.

In order to establish a sound basis for speculation and experimentation, the extensive literature dealing with the ultraviolet transmission of the eye media was reviewed. The great discrepancies concerning human eye media are partly understandable as due to differences in age and pathology. The low transparency figures and high absorption limits of the rabbit eyes seem to indicate that many authors, through their spectral arrangement, have measured more total than pure absorption.* The former can reach high values when the eye media become lightly clouded. This happens very easily to the separated cornea and lens capsule. Birch-Hirschfeld for example, found the absorption limit of the cornea at 306 mμ and that of the lens between 330 and 390 mμ. These figures refer to the rabbit but were considered as independent of the type of animal. Parsons obtained the absorption limit of the rabbit lens at 350 mμ. (See Trümpy's article[9] for references.) These values differ considerably from those obtained by other authors.

Physical studies

It thus appeared imperative to obtain proper and significant absorption values. For this purpose comparative measurements of total and true absorption were conducted on rabbit eyes. A normal Ringer solution was found appropriate for bathing the lens. A slightly hypertonic, alkaline Ringer solution appeared optimal for the cornea. Drying out of the specimen was carefully prevented. Even with these precautions considerable differences between true and total absorption were observed.

True absorption was measured by placing the lens or cornea in immediate contact with the slit of the quartz spectrograph and expos-

* Pure absorption is due to transformation of radiation into other forms of energy (chemical, electrical, thermal). Total absorption, in addition, includes loss through scatter, that is, deviation of the primary rays from their original direction. (This, in case of an increased wavelength, includes fluorescence.)

ing it widely through a frosted quartz plate. Total absorption was determined by increased distance between the specimen and the slit, omission of the frosted plate, and exposure to a pencil of ultraviolet rays.

Serial photographic spectrograms were obtained for exposures ranging between 0.05 to 10 seconds (true absorption) and 0.5 to 100 seconds (total absorption) and evaluated photoelectrically. Table 1 gives the results, averaged from three series of observations.

Under biologic conditions (of close contact between pupil, cornea, and lens), it is the true absorption (plus reflection) which determines the penetration through the eye media. It is also more the true—that is, chemical absorption (minus reflection)—than the total absorption that is responsible for the pathologic effects, since scattering is a physical phenomenon which contributes little to the biologic effects. Assuming a three- to five-percent reflection from the cornea, one has to expect maximal biologic effects upon the latter below 300 mμ, with the possibility of responses throughout the near ultraviolet between 300 and 400 mμ. For the lens the situation is different. Its true absorption is considerable in the near ultraviolet. Within the middle and far ultraviolet, however, the cornea protects the lens very effectively. Below 293 mμ this protection is complete. Table 2 gives quantitative results, obtained from the data of Table 1.

TABLE 2

TRUE ABSORPTION OF RABBIT LENS IN SITU

λ (mμ)	% Penetration through Cornea	% Absorption of Separated Lens Corrected for Reflection 5–10%	% True Absorption of Lens in situ
436	96	3	3
405	94	6	6
391	85	39	33
365	80	89	71
334	60	91	55
313	45	91	41
302	19	90	17
297	6	90	5
293	0	90	0

The in situ or in vivo absorption of the lens is maximal around 365 mμ. It becomes practically zero in the visible and far ultraviolet (>400, <300 mμ). From these figures it appears that the near ultraviolet (including 297 mμ) has a better chance to produce (direct) lens injuries than the visible light. As far as the human eye is concerned, it is known that the lens absorption is greater than in the rabbit and that it increases with advancing age and cataractous conditions. Measurements on human eye material were not made. The cornea of the guinea pig was found to be definitely more transparent than

TABLE 1

ABSORPTION OF RABBIT CORNEA AND LENS

λ (mμ)	Cornea			Lens		
	Absorption (%)			Absorption (%)		
	Total	True	Scatter	Total	True	Scatter
435	36	4	32	75	8	67
405	38	6	32	79	12	67
391	39	15	24	90	45	45 x
365	41	20	21	99	96	3 x
334	60	40	20	100 –	99	1 x
313	75	55	20	100	100 –	0 +
302	92	81	11	100	100	0
297	98	94	4	100	100	0
293	100	100	0	100	100	0
	Including Reflection			Including Reflection		x Including Fluorescence

that of the rabbit. It was still perceptibly transparent for the wavelength 293 mμ. The lens of the guinea pig appeared to absorb more than the rabbit lens. These facts explain the high susceptibility of the guinea pig for experimental radiation cataract. Accurate measurements could not be obtained due to the high refractive power of the lens of the guinea pig.

Biologic studies

For the experimental production of eye injuries the right eyes of 78 albino rabbits and 24 guinea pigs were exposed to ultraviolet rays of different wavelengths and dosage. The left eyes were usually kept as controls. The animals were lightly anesthetized with nembutal-urethane. The pupils of both eyes were dilated through atropine. In the first series of experiments both eyes were kept moist by drops of saline from a burette. Later on the eyes, kept open by hemostats on the upper eyelashes, were closed every two minutes to keep their surfaces moist. At the end of the experiment a drop of dilute boric acid was applied to the eyes.

The following ultraviolet generators were used:

1. A low pressure, high voltage mercury arc "cold quartz" (Mediquartz, Dallons Laboratories, Los Angeles).
   a. Unfiltered, range from 240 mμ into visible light, 254 mμ predominating, 130,000 erg/cm² sec.
   b. Filtered through bromine-chlorine vapor, 254 mμ almost pure, (>99 percent) 270,000 erg/cm² min. (low intensity).
2. A watercooled mercury arc (Kromayer).
   a. Unfiltered, range from 240 mμ into visible light, middle and near ultraviolet predominating, 430,000 erg/cm² sec.
   b. Glass-filtered, range from 302 mμ (<1 percent) into visible light, 62,000 erg/cm² sec.
3. A medium pressure, high voltage mercury arc (General Electric AH6).
   a. Filtered through one Corning 5874 and a quartz-running water-filter (1 cm. thick), range from 313 (seven percent) to 405 mμ (four percent), 15,000,000 erg/cm² sec.
   b. Filtered through two Corning 5874-filters and one water-filter, range 334 (one percent) to 391 mμ (two percent), 6,000,000 erg/cm² sec.

The spectral ranges were determined by quantitative evaluation of serial spectrograms. The ultraviolet energy output was measured through an electronic photometer (Photovolt 514 M, phototube B).

The eyes were observed, first at daily, later at weekly, intervals by means of the slitlamp. For corneal lesions fluorescein was mostly used. This method appeared useful for the establishment of a threshold keratitis and for a grading of more severe reactions. The usefulness and accuracy of the method depended upon the preservation of the normal integrity of the corneal surface. The animals were kept singly in a cage and the cages were placed in the upper row. Particular care was taken to keep cages and animals clean. The eyes were examined with the slitlamp before exposures. Defective eyes were not exposed. Occasional scratchlike or ulcerlike takes after exposures were discarded as ultraviolet responses.

The rabbits were preferred for corneal studies. Most lens injuries were observed in the guinea pigs. Turbidities of the aqueous humor, lens capsule, and lens were studied with the slitlamp.

In general the following reactions were observed:

1. Keratitis, corneal opacity, palpebral and bulbar conjunctivitis occurred within the range of 254 to 313 mμ with low dosage. Excessive radiation of 334 mμ also produced occasional responses. All the reactions were reversible (within three to six days).
2. Iritis (congestion and hemorrhage)

and turbidity of the aqueous humor were noticeable after partial recovery from keratitis or corneal opacity, usually three to six days after exposure.

3. Reversible blurring of the exposed lens capsule and front of the lens were observed, usually five to 10 days after exposure. These reactions occurred regularly in the guinea pig and occasionally in the rabbit.

4. Irreversible lenticular opacities (cataract) occurred in the exposed frontal layers of the lens after repeated, excessive irradiation by wavelengths 297 to 365 mμ. These reactions occurred in many guinea pigs and in one rabbit, with a variable latency, ranging from 2.5 to 14 months. This response is a typical "direct cataract," produced by the absorption of ultraviolet energy in the lens, and not indirectly through injury of the ciliary body through scattered radiation and a resulting nutritional deficiency of the lens, as claimed by van der Hoeve[6] on the basis of his observations and of his interpretation of Trümpy's experiments.[9]

Quantitative and comparative responses of the cornea and lens of the rabbit and the guinea pig to radiations of different wavelengths are given in Table 3.

The approximate threshold of the rabbit cornea refers to observations with the slitlamp and fluorescein. The definite blurring of the corneas of rabbit and guinea pig concerns a blurring well noticeable with flashlight observations. Lens opacities were observed with the slitlamp, when the corneal blurring and aqueous turbidity had sufficiently receded. Cataract figures refer to definite late opacities of the lens which appeared irreversible. These occurred almost exclusively as cumulative effects of repeated applications (two to four exposures within two to 10 weeks).

In spite of the use of the filter method, which, as a rule, represents a sharp cut-off only toward shorter wavelengths, the dosage figures obtained were significant for the indicated wavelengths. The 254 mμ line predominated sufficiently over the rest of the spectrum, and its efficiency was sufficient to make it representative for the cold quartz ultraviolet spectrum. The order of magnitude of efficiency fell off so decisively from 297 to 313 to 334 mμ and so forth, that the borderline wavelengths were representative for the filtered spectrum. Although it is admitted that the monochromator method of Cogan and Kinsey was preferable for accuracy, the filter method was the only one available for the application of the heavy dosage used in this study.

It may be stated, however, for the matter of principle, that light from the prism monochromator contains an uncontrolled impurity of scattered rays of a wide range of wavelengths and may not be superior to the filtered light for certain purposes, particularly when spectral lines of very low intensity are used.

TABLE 3

RESPONSES TO RADIATIONS OF DIFFERENT WAVELENGTHS

Reactions	254 Predominating	Containing 297 & 289+	Only above 302	334–365 Only	λ mμ
Rabbit cornea, approximate threshold	$0.5 \cdot 10^6$	$0.4 \cdot 10^6$	$25 \cdot 10^6$	$10 \cdot 10^9$	DOSAGE erg/cm²
Rabbit cornea, definite blurring	$2 \cdot 10^6$	$1.3 \cdot 10^6$	$200 \cdot 10^6$	$100 \cdot 10^9$	
Rabbit lens, opacity	— (∞)	($2 \cdot 10^6$)	($150 \cdot 10^6$)	($50 \cdot 10^9$)	
Guinea pig cornea, definite blurring	$2 \cdot 10^6$	$1.5 \cdot 10^6$	$200 \cdot 10^6$	$100 \cdot 19^9$	
Guinea pig lens, opacity	— (∞)	$1 \cdot 10^6$	$100 \cdot 10^6$	$50 \cdot 10^9$	
Guinea pig lens, catract	— (∞)	$3 \cdot 10^6$	*$400 \cdot 10^6$	*$300 \cdot 10^9$	

* Cumulative from repeated applications.

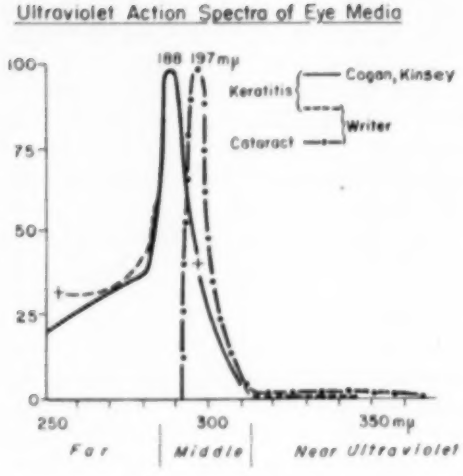

Fig. 1 (Bachem). Ultraviolet action spectra for keratitis and cataract.

Even with the excessive dosage employed, heat cannot be considered responsible for the observed effects. The "cold quartz" emits a negligible amount of visible and infrared rays. The Kromayer lamp is water-cooled and the rays of the AH6 lamp were filtered through running water between the Corning filter(s) and the eye. Control experiments on the author's skin proved the lack of excessive heating.

The ultraviolet action spectra for keratitis and cataract are shown in Figure 1. Since the filter method was inappropriate to demonstrate the sharp peak at 288 mμ, as established by Cogan and Kinsey for keratitis, the action spectrum of these authors was accepted for the middle ultraviolet region. My observations indicate a slightly different ratio for the efficiencies of 254 and 297 mμ radiations in favor of the 254 line. The long wave part of the action spectrum has been extended into the near ultraviolet in order to indicate the response to excessive dosage, observed by me. The action spectrum for cataract is very characteristic. The representative curve begins abruptly between 293 and 297 mμ, reaches its peak near 297 mμ, falls rather abruptly to 313 mμ and has a long tail through the near ultraviolet.

Handman[10] and others have statistically demonstrated that senile cataract starts mostly in the lower nasal quadrant of the lens. He interprets this fact as a result of the predominant exposure of that part of the lens to daylight. Since daylight does not contain the far ultraviolet and far infrared rays, and since the visible and near infrared rays penetrate the eye media practically without true absorption, it appears to me that the near ultraviolet components of daylight are responsible for senile cataract. This statement, of course, does not rule out other contributory factors (hereditary susceptibility, metabolic, pathologic, ionic influences, heat acceleration, and so forth.

Schanz and Stockhausen[11] even attribute the glassblower-cataract to the near ultraviolet components rather than to the infrared rays of the hot flame. Protection of the eyes against the near ultraviolet rays by amber colored or uncolored glasses might therefore be advisable. The replacement of the incandescent electric light by the bluish fluorescent light of extravagant intensity should be considered in view of these findings.

Conclusions

1. The ultraviolet rays ophthalmically most effective are the "actinic" rays near 300 mμ: 288 mμ for the cornea (as established by Cogan and Kinsey), 297 mμ for the lens (as observed in this study).

2. Ultraviolet rays of shorter wavelengths (far ultraviolet) are relatively harmless for the eye. They produce no lens injury, but may cause corneal and conjunctival inflammation.

3. Ultraviolet rays of longer wavelengths can cause cataract through the cumulative effect of repeated excessive dosage. This conclusion is based upon my study of the true absorption of the eye media, my biologic experiments, and the observations and discussions of several ophthalmic authors.

Department of Physiology.

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THE DIFFERENTIAL DIAGNOSIS OF DARK LESIONS OF THE POSTERIOR FUNDUS*

JEROME W. BETTMAN, M.D., AND VICTOR FELLOWS, M.D.
San Francisco, California

The clinical problem of the diagnosis and management of small dark lesions of the posterior fundus is a difficult one. Most of us who have practiced a long while have either enucleated eyes unnecessarily or have failed to enucleate eyes harboring malignant melanomas, or both. The literature is replete with pathologic and statistical studies of these lesions and of isolated case reports. The present paper is purely a clinical consideration of the problem of diagnosis and management from a clinician's viewpoint. The discussion is limited to small dark lesions visible opthalmoscopically.

The importance of a careful evaluation of diagnostic signs is emphasized by the frequency with which melanomas are misdiagnosed, and the relationship of early diagnosis and prognosis.

How often are melanomas of the fundus misdiagnosed? Probably the best estimate is that of Fry[1]—approximately 10 percent of histologically proven melanomas were not diagnosed clinically, and approximately 10 percent of eyes diagnosed as harboring melanomas did not contain one. Does an early diagnosis of melanoma significantly alter the patient's prognosis for life? The answer to this question is emphatically *yes*. Flocks, et al.,[2] is an excellent pathologic study, demonstrated that the death rate associated with larger tumors was very much greater than the mortality rate associated with smaller tumors.

A dark lesion of the posterior fundus may be a melanoma, either benign (nevus) or malignant, a subretinal hemorrhage, a disciform mascular degeneration, an inflammatory lesion, or a hemangioma.

It is well known that a hemorrhage behind the retina may be the first sign of disciform degeneration. Such a hemorrhage presents as a localized, dark, elevated mass

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and looks precisely like a melanoma. A nevus may appear slightly elevated, dark, and localized, and may occasionally be confused with a melanoma. A melanoma itself may or may not be very elevated, may vary in color from very light to all shades of darkness, and the pigment may be unevenly distributed, as usually seen in chorioretinitis. A hemangioma is elevated, localized, and may be darker than the surrounding fundus. Inflammatory lesions may also appear as localized dark masses. It is not surprising that the diagnostic errors average approximately 10 percent. Such diagnostic errors cost an eye or a life.

Differential diagnosis

The differential diagnosis will be presented as the clinician views them: first ophthalmoscopically, then by contact lens and slitlamp microscopy; and finally the special aids to diagnosis such as visual fields, transillumination, aspiration studies, and radioactivity tests.

Ophthalmoscopic examination

On ophthalmoscopic examination all these lesions are dark by definition. The pigment is so conspicuous that it tends to dominate the clinical picture, but pigmentation contributes little to the diagnosis or prognosis. The "blue ointment" appearance of choroidal nevi is usually characteristic but even in this instance the pigmentation can be misleading since these lesions can become darker or lighter without reference to malignant change.[3]

The location of the lesion is of some help in the differential diagnosis. Disciform degeneration occurs only in the macular region, but it may be eccentric in relation to the fovea. Melanomas may arise anywhere, but those in the macula must be regarded with suspicion as the possibility of disciform degeneration is so great in this region.

The size of the lesion is of no aid in the diagnosis, but the rate of increase in size is. A marked increase in size within a few days speaks against a tumor and is more characteristic of a disciform lesion associated with hemorrhage or serous fluid. Increase in size associated with increasing blurring of the lesion is in favor of inflammation.[6] A tumor tends to become more distinct as it becomes larger. The lack of enlargement is not against the possibility of tumor since melanomas may remain apparently unchanged in size for months or longer and then enlarge relatively rapidly.[7]

If the dark lesion is associated with hemorrhage then the weight of evidence is overwhelmingly against melanoma. Much has been said of the possibility of melanomas being associated with hemorrhage. Generally the hemorrhage occurs with larger or necrotic melanomas or ones that have broken through Bruch's membrane. Small melanomas of the posterior pole are so rarely associated with hemorrhage that the eye should not be enucleated unless there is some other unusual reason for enucleation. Grossly visible subretinal hemorrhage is frequently found with disciform macular degeneration. Of 24 cases of disciform degeneration diagnosed pathologically, Frayer found three had been mistakenly removed with a clinical diagnosis of melanoma.[4] Clinically, a small dark lesion with hemorrhage is so likely to be a disciform degeneration, and is so rarely a melanoma, that this writer will not again enucleate such an eye without prolonged observation.

Occasionally a hemorrhage below the retina or in the choroid will appear only as a dark globular mass which transilluminates poorly. If such a lesion does not show a slight redness in one area, suggesting blood by ophthalmoscopic examination, it will usually show this on slitlamp and contact lens examination. If the slitlamp beam is directed slightly to one side of the lesion, slight pink or reddish halo may be seen at the edge of the lesion.[22] Absence of new blood vessels deep to the retina in the latter may make one suspect that a melanoma is not present. If

one remains in doubt, time, drawings, and fundus photography may provide a more satisfactory answer than histologic examination. With the passage of time, such an elevated localized dark lesion gradually transforms into the characteristic elevated white lesion of disciform degeneration.[5]

Traction folds, whether radial or concentric, are frequent in inflammatory lesions, especially when fresh. The concentric folds may be found with angiospastic retinopathy, central serous retinopathy, or edema of the retina. Traction folds of any type are rare with tumor and are definitely against this diagnosis.[6]

A retinal detachment associated with a dark lesion of the posterior pole is the sign par excellence of a melanoma. The elevated retina tends to be smooth, with little tendency to wrinkle, and usually without a break. Difficulties in diagnosis occur if the detachment is so extensive and the retina so elevated that no indication of a tumor is present. If the detachment does not reach the periphery, or no break in the retina is present, one should be suspicious and a proper period of bedrest with binocular pads may reveal the diagnosis. The use of radioactive phosphorus and of aspiration of the subretinal fluid are possible aids which will be discussed later.

The retinal separation may be so slight that it is overlooked without careful slitlamp examination, or it may be so far in the periphery and so slightly elevated that it is overlooked without careful field studies.[8] The significance of a retinal detachment with a dark lesion is the same whether the detachment is extensive or minimal, central or peripheral—it means that the lesion is very probably a melanoma. In occasional cases a slight elevation of the retina may be seen adjoining a disciform lesion if the lesion is examined by slitlamp microscopy.[22]

Other signs on ophthalmoscopic examination which are of occasional aid are presence of a light fringe or marginal pigment disturbance which is against a nevus,[9] vitreous opacities which draw attention to an inflammation, and drusen. These excresences of the lamina vitrea are consistent with a melanoma but can occur with any chronic disturbance of this glossy membrane.

Slitlamp microscopy

Examination of a fundus lesion is not complete without slitlamp microscopy. The contact lens is to be used in preference to the preset lens (Hruby). The slitlamp should be used with a very narrow beam to diagnose changes in density such as thickening of the retina or presence of a slight elevation of the retina with a narrow slit of subretinal fluid which may appear as a translucent interval in the beam. It should also be used with a broad beam to indicate changes in color, as with a localized deep hemorrhage, and to search for newly formed blood vessels behind the retina.

Careful observation of the termination of the slitlamp beam indicates whether a slight elevation is present. If the end of the beam is concave forward the lesion is not elevated; if the beam is flat on the end or convex forward it indicates elevation.

A careful study of the retina overlying the lesion should be made. An increase in thickness of the retina suggests a hemangioma. On pathologic examination hemangiomas may show a membrane overlying them from proliferation of the pigment epithelium.[5] The adjacent retina may become edematous, cystic, or atrophic. This may cause an uneven appearance on ophthalmoscopic examination, and may result in the characteristic sector defect of the visual field. Such eyes should not be enucleated but should be treated with diathermy or radiation therapy.

If the retina appears indistinct and cells are present in the vitreous in front of it, an inflammatory lesion is likely. Rones and Linger[10] found cystoid degeneration of the overlying retina as the most striking change in a majority of early melanomas on patho-

logic examination. In our own clinical experience the retina overlying early melanomas appears quite normal to slitlamp examination.

If the retina over the lesion is found to be normal, it tends to rule out an inflammatory lesion as well as a hemangioma. Every effort should be made to determine if newly formed vessels are present and whether these are independent of the retinal circulation. The latter usually indicates a neoplasm, but may also be found in some cases of disciform degeneration.

Visual field studies may be extremely helpful in three ways. One of the principal differentiating signs between a melanoma and a nevus is the presence of a scotoma corresponding to the lesion. Usually a nevus does not disturb the choriocapillaris and thus interfere with the rod and cone function and produce a scotoma; whereas a melanoma does. However, a nevus may produce a scotoma. If a scotoma is found corresponding to a lesion which appears to be a nevus, prolonged observation rather than immediate enucleation is indicated. A peripheral depression of the visual field, especially superiorly, should cause the examiner to search even more diligently for a retinal detachment. If the latter is found in the presence of a small dark lesion, the eye should be enucleated. A sector defect in the field is associated with a hemangioma. If the retina is thickened, or its surface is uneven, and this sector defect is present, then diathermy or radiotherapy is indicated.

Before proceeding to ancillary diagnostic aids, let us summarize the significant findings on ophthalmoscopic and slitlamp and visual field examination of a small, dark, elevated lesion. A melanoma is unlikely if there is hemorrhage, traction folds, indistinct retinal markings, thickening of the retina, or a sudden change within a few days. A melanoma is likely if new blood vessels, not part of the retinal circulation, or a retinal detachment is present with the small dark lesion. This is especially true if the retinal detachment is smooth, moves poorly, and presents no break. A nevus is usually diffusely bluish in color, elevated microscopically, if at all, and has no corresponding scotoma or only a slight relative one. A hemangioma results in a thickened or cystic or edematous retina and a sector field defect. If the lesion is flat, light, and tends to be diffuse, a metastasis should come to mind.

Special aids and tests

Of the ancillary tests used in the diagnosis of possible melanomas, transillumination is the most widely used and probably the least rewarding. The usual method of placing a bright light on the conjunctiva and gazing at the pupil from some distance away is useless. The examiner's eye must be placed very close to the patient's eye with or without an ophthalmoscope, but with the light of the later turned off. The light of the transilluminator must be bright and may be placed on the conjunctiva or forced between the margins of the eyelids and the orbital walls.[11] Neoplasm, hemorrhage, and inflammation may all cast a dark shadow and are not differentiated. A neoplasm that is necrotic and cystic or flat and light may transilluminate well. If the light is too dim the lesion may not be seen; if it is too bright diffusion may obscure the lesion.

Elevation of the ocular tension is sufficiently rare that it is of no help in the diagnosis.[12] Although small tumors are very occasionally associated with an elevated tension, usually the tumor is sufficiently large that it does not come within the scope of this paper.

The possibility of obtaining some information by passing a needle into the eye has tempted many ophthalmologists. In 1900, Silcock passed a needle through the sclera in the quadrant opposite the detachment and observed with the ophthalmoscope while he felt the lesion. If it felt solid or it bled, a melanoma was diagnosed and the eye was

enucleated.[12] More recently Kauffman[13] passed a needle across the vitreous and into the lesion in the same manner, applied negative pressure on the luer after the needle was in the lesion, and obtained some cells for biopsy. Long, et al.,[14] inserted a needle where the retina was most markedly elevated. Cibis[15] tested the subretinal fluid for melanin and found positive results in all five of the cases tested.

Aspiration biopsy has only been performed on a few patients because the procedure is frequently unsatisfactory and is potentially dangerous. It is often impossible to make a definite diagnosis from the few cells obtained. The advocates admit that a negative result means nothing. There is danger of extrabulbar extension through the puncture wound.[16] Because of this danger immediate enucleation is recommended if the biopsy is positive, but if it is negative there is a definite possibility of having disturbed a tumor which was not detected. It is probable that this method of diagnosis is less reliable than good clinical judgment.

Recently the uptake of radioactive phosphorus (P_{32}) has been used as an aid to the diagnosis of possible melanomas.[17] The P_{32} is administered intravenously in the form of sodium-acid phosphate. This is carried throughout the vascular tree and counts taken over any lesion within an hour or so after the injection simply give an indication of the vascularity of that lesion, not of the malignancy. As time elapses the phosphorus enters into combination with carbohydrates, fats, and proteins. The protein equilibrium is the slowest to be established.[18] A count taken one to two days after the injection gives an indication of the amount of radioactive phosphorus in combination with proteins. As neoplasms contain more nucleoprotein, an increase in the ratio of counts in 24 hours as compared to the same at one hour is significant.[19] In order to be at all accurate, it is essential that the tip of the counting probe be placed directly over the lesion. For posterior lesions this has necessitated the design of special probes which can be placed behind the globe through a conjunctival incision.[20, 21]

The pitfalls in the P_{32} test are numerous: certain tumors, probably necrotic and cystic ones, do not take up P_{32} as well as other tumors; a misleading high count may be obtained if the counting probe is placed over tissues with a relatively high vascularity and metabolism, such as rectus muscles or ciliary body. If the tip of the counting probe is not placed close to the lesion few, if any, of the radioactive beta particles from the P_{32} will register. Because of these difficulties the use of P_{32} in the diagnosis of intraocular tumors is certainly no more accurate than good clinical judgment, and probably not as good. It is a test that is useful as an ancillary diagnostic tool, not as one which gives the final decision.

Comments

We have presented the subject of the diagnosis of dark fundus lesions dogmatically. We have stressed that hemorrhages or traction folds weigh strongly against the diagnosis of melanoma, whereas a retinal detachment in the presence of a dark lesion is overwhelmingly in favor of it. We have emphasized the importance of careful slitlamp examination of the fundus to determine whether the retina is detached and, if so, whether it is translucent, whether new blood vessels are present, and if the retina is thickened. Usually the diagnosis must depend more on ophthalmoscopic and slitlamp findings than on any other tests. However, visual field studies may help differentiate between a nevus and a melanoma, or point to an obscure flat detachment, and the use of radioactive phosphorus may aid in the diagnosis.

In spite of the didactic presentation, there are confusing exceptions to these clinical guides. Even small melanomas can be associated with hemorrhages in rare instances; retinal detachments may be confusing; nevi are sometimes associated with scotomas; new

blood vessels deep to the retina can be seen with disciform lesions. If there is doubt as to the diagnosis, enucleation should be delayed until a series of fundus photographs and careful drawings can be compared over a period of time. A general physical examination should be obtained to rule out a metastatic lesion. If a retinal detachment is present, bedrest with bilateral pads should be undertaken.

The prognosis associated with a small melanoma is definitely better than the prognosis with a large one, but the association is not so direct that we cannot take time to arrive at an accurate diagnosis by using drawings and photographs. There is as yet no laboratory substitute for good diagnostic acumen.

2400 Clay Street (15).

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EYE INFECTIONS FOLLOWING CATARACT EXTRACTION*

With special reference to the role of Staphylococcus aureus

Deborah Locatcher-Khorazo, M.D., and Elizabeth Gutierrez, B.A.
New York

In a previous study on the incidence of postoperative infection, 11 cases of endophthalmitis in 2,508 operations for removal of cataract were recorded.[1] In all of the infections the offending organism, Staphylococcus aureus, was present in the preoperative cultures. Furthermore, Staphylococcus aureus was found in 529 of the 2,508 eyes on which preoperative cultures were done. These observations led to the routine preoperative use of antibiotics in all cataract extractions. The results obtained from January 1, 1945, to October 1, 1955, are recorded along with some observations on the changing characteristics of Staphylococcus aureus.

Method

Since 1945, most patients for cataract extraction have been admitted to the hospital the day before the operation and during this period have received approximately five local preoperative prophylactic treatments with antibiotics in ophthalmic ointment. The selection of antibiotic was made by the surgeon in charge of the patient. The ophthalmic ointment was applied by pulling down the lower lid to create a small cup in the lower fornix in which the ointment was placed. While still exerting traction on the lower lid, the patient closes his eye and keeps it closed gently without squeezing for several minutes to permit even distribution of the ointment. Later the excess ointment is wiped from the eye. Such treatment was given every two or three hours for the 24-hour period. Some of the patients received antibiotic ophthalmic preparations and were instructed in the technique of applying the agent themselves at home prior to admission, when a bed was not available.

Prolonged preoperative treatment was given to a limited number (567) in whom Staphylococcus aureus had been found preoperatively. Surgery was deferred until sterile cultures had been obtained. In the meantime, the sensitivity of Staphylococcus aureus to various antibiotics was determined. The method of taking repeated cultures and of testing isolated organisms for sensitivity to antibiotics has been reported previously.[2] In this group tests of sensitivity were made by placing discs containing the various antibiotics on the surface of an inoculated blood agar plate which was then incubated at 37°C. for 18 to 24 hours and examined for the presence or absence of growth around the discs. By this method it was possible to determine the approximate sensitivity of the organism to several antibiotics simultaneously.

Results

A total of 7,662 cataract extractions were performed from 1945 to October, 1955. The operations included intracapsular, extracapsular, loop, and linear extractions. All these patients received preoperative antibiotic treatment. No preoperative cultures were obtained on 3,854 but, in the remaining 3,808, where the bacterial flora was known before operation, Staphylococcus aureus was found in 1,545. The 7,662 cases were divided into four groups (table 1).

In Group 1 are 3,854 operations with no preliminary preoperative cultures. There were five cases of endophthalmitis, four of which were caused by Staphylococcus aureus and one by Escherichia coli. In two of the five infections, the extractions were done

* From the Departments of Ophthalmology and Microbiology, Institute of Ophthalmology and Columbia University College of Physicians and Surgeons, Presbyterian Hospital.

TABLE 1

INCIDENCE OF POSTOPERATIVE INFECTIONS IN 7,662 CASES FOLLOWING INTRACAPSULAR, EXTRACAPSULAR, LOOP, AND LINEAR EXTRACTIONS OF THE LENS FROM 1945 TO OCTOBER, 1955

Group	Number of Operations	Types of Operations		Postoperative Culture	Preoperative Treatment	Postoperative Endophthalmitis	Organisms Isolated Postoperatively
1	3,854	Intracapsular Extracapsular Loop and linear	3,217 512 125	Not available	Five local applications of antibiotics	2 2 1 None	Staph. aureus Staph. aureus E. coli
2	2,263	Intracapsular Extracapsular Loop and linear	1,787 425 51	Staph. aureus absent	Five local applications of antibiotics	None	
3	978	Intracapsular Extracapsular Loop and linear	770 183 25	Staph. aureus present	Five local applications of antibiotics	None 1 None	Staph. aureus and Ps. aeruginosa
4	567	Intracapsular of these Extracapsular of these Loop and linear	452 52 108 8 7	Staph. aureus present E. coli or Proteus vulgaris Staph. aureus present E. coli or Proteus vulgaris Staph. aureus present	Operation deferred for supplementary local treatments with antibiotics until bacteria eliminated	None	

intracapsularly and, in three, the extracapsular technique was used.

Group 2 comprised 2,263 operations in which Staphylococcus aureus was absent from the preoperative eye. No postoperative endophthalmitis occurred.

Group 3 consisted of 978 cases in which the preoperative culture revealed the presence of Staphylococcus aureus. In this series there was one case of endophthalmitis. Staphylococcus aureus and Pseudomonas aeruginosa were both isolated postoperatively, but Pseudomonas aeruginosa had not been found preoperatively.

Group 4 included 567 cases in which Staphylococcus aureus was present preoperatively and, in 60, Escherichia coli or Proteus vulgaris was also found. This group differs from Group 3 in that the operations were deferred and supplementary local treatments with antibiotics were given until bacteria were no longer recovered from the cultures. In this series no postoperative infections occurred.

CHANGING INCIDENCE OF STAPHYLOCOCCUS AUREUS: ITS SENSITIVITY TO ANTIBIOTICS

The incidence of Staphylococcus aureus appears to have been increasing in the eyes of preoperative patients and probably in the

TABLE 2

PREVALENCE OF STAPHYLOCOCCUS AUREUS IN EYE CULTURES

Period	Source	Age Group	Total Number of Eyes	Staph. aureus (percent)
1934	Normal eye	<1–70	1,084	23
1938–1945	Preoperative eye	39–90	2,508	21
1945–1947	Preoperative eye	40–90	1,245	31
1947–1955	Preoperative eye	40–90	2,489	42.5
Fall of 1954	Normal eye	18–30	181	68

normal population as well. Table 2 shows the results of cultures obtained in 1934 and from 1938 to 1955 from normal individuals and from cases admitted for eye surgery of all types. It may be observed that, in 1934, in a group of 1,084 normal individuals ranging in age from the newborn to people over 70 years of age, the incidence of Staphylococcus aureus in the eyes was 23 percent. From 1938 to 1945, the incidence of Staphylococcus aureus in the eyes of patients admitted for surgery was 21 percent but this increased in 1945 to 1947 to 31 percent. From 1947 to the present, the incidence of Staphylococcus aureus in the preoperative eye has averaged 42.5 percent.

In the fall of 1954, the eyes of 181 medical or dental students and technicians were cultured. Staphylococcus aureus was found in 68 percent of their eyes.

The 1934 series of 1,084 cultures from normal eyes has been analyzed for the carrier rate of Staphylococcus aureus in different age groups. This organism was present in 21 to 25 percent of the cultures, irrespective of the age of the subjects which indicates that age was probably not a factor in the carrier rate.

The number of strains of Staphylococcus aureus sensitive to penicillin has been decreasing steadily (fig. 1). From 1945 through 1950, 86 percent of the strains of Staphylococcus aureus isolated from eyes were sensitive to penicillin. While from 1951 to 1954, only 22 percent showed this sensitivity.

This decrease in the sensitivity of Staphylococcus aureus is not confined to penicillin alone. A similar decrease to terramycin and chloramphenicol has been noted. From 1951 through 1953, 64 percent of strains of Staphylococcus aureus isolated from the eyes were sensitive to terramycin, while in 1954, only 41 percent of such strains were sensitive. During this time the proportion of strains sensitive to chloramphenicol has dropped from 66 to 31 percent and to streptomycin from 55 to 38 percent.

The two new antibiotics ilotycin and achromycin at present are the most active in vitro. In addition to these antibiotics, magnomycin, bacitracin, aureomycin, and neomycin have been tested on 1,175 strains of Staphylococcus aureus isolated in 1953 and 1954. Like penicillin they have shown relative low activity in vitro.

The preoperative distribution of Staphylococcus aureus in the eyes of 12 patients who

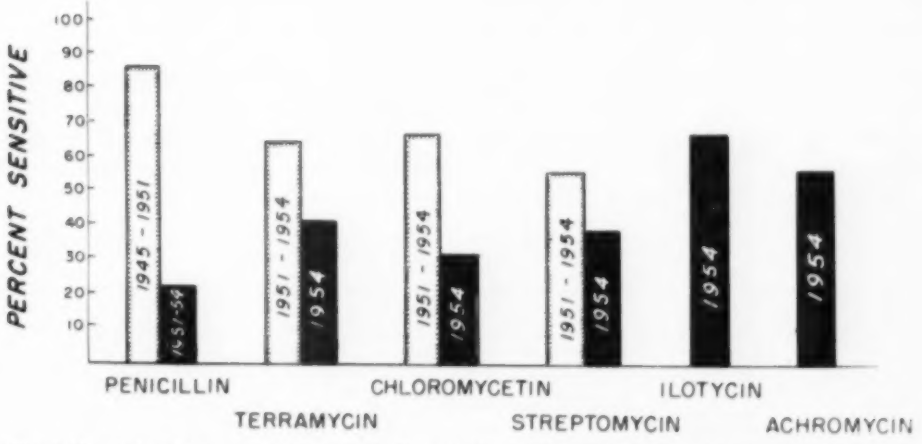

Fig. 1 (Locatcher-Khorazo and Gutierrez). Comparative in vitro studies of sensitivity of Staphylococcus aureus to various antibiotics in different years.

TABLE 3

DISTRIBUTION OF STAPHYLOCOCCUS AUREUS IN THE PREOPERATIVE EYE AND IN EXTRAOCULAR FOCI IN 12 CASES WITH POSTOPERATIVE ENDOPHTHALMITIS

Staph. aureus Present	In Preoperative Eye			In Non-operated Eye	In Nose	On Skin of Face
	Conjunctiva Only	Eyelid Only	Conjunctiva and Eyelid	Conjunctiva and Eyelid		
Cases	1	4	7*	12	12	1†

* Two cases had diabetes mellitus.
† Allergic dermatitis; only case in which skin of face was cultured.

developed Staphylococcus aureus endophthalmitis is presented in Table 3. Eleven of these cases were reported previously.[1] The 12th case is from Group 3 of Table 1. The four cases of Staphylococcus aureus endophthalmitis of Group 1, Table 1, could not be included because there were no preoperative cultures.

It may be noted that in the 12 cases of endophthalmitis, Staphylococcus aureus was present in the conjunctiva alone in only one patient (three colonies only). In four cases, the organism was cultured from the eyelids alone. In the seven remaining patients, Staphylococcus aureus was found in both conjunctivas and the eyelids. Of these seven cases two had diabetes mellitus. All 12 cases had Staphylococcus aureus in the nonoperated eye and in the nose. One case had allergic dermatitis, this was the only case in which the skin of the face was cultured and Staphylococcus aureus was recovered. These data raise a question concerning the usual distribution of Staphylococcus aureus in the preoperative eye.

Table 4 shows the distribution of Staphylococcus aureus in the eyes of 1,201 preoperative patients. All 1,201 cases carried the organism in the eyes being prepared for surgery, 757 carried Staphylococcus aureus in both eyes. From these patients, the number of eyes which had Staphylococcus aureus was therefore 1,958 and the distribution of Staphylococcus aureus in these eyes was as follows:

The organism was present in both conjunctiva and eyelid in 1,086 eyes, in the eyelids only in 734, and in the conjunctiva alone in only 138 eyes. Usually more colonies of Staphylococcus aureus were isolated from the eyelids than from the conjunctival cultures. The eyelids therefore can be an important source of infection. It is also obvious that the presence of Staphylococcus aureus in the nonoperated eye may be a source of infection.

Table 5 presents the extraocular occurrence of Staphylococcus aureus, Escherichia coli, and Proteus vulgaris in the 567 patients of Group 4 in Table 1. These are the cases carrying Staphylococcus aureus in which the operation was delayed for further prophy-

TABLE 4

PREOPERATIVE EYE CULTURES CONTAINING STAPHYLOCOCCUS AUREUS: DISTRIBUTION OF THE PATHOGENS IN EACH EYE

Number of Patients	Number of Patients with Staphylococcus aureus in Both Eyes	Number of Eyes with Staphylococcus aureus	Distribution of Staphylococcus aureus in Each Eye		
			Present in Both Conjunctiva and Eyelid	Present in Eyelid Only	Present in Conjunctiva Only
1,201	757	1,958	1,086	734	138

lactic treatment. In may be seen that Staphylococcus aureus was frequently present not only in the opposite eye but in the nose and throat and on the skin around the eyes. Twenty-two patients also had Escherichia coli in the preoperative eye. The same organism was isolated from the nose in 10, from the throat in three, and from the skin around the eye in two of the patients. Thirty-eight cases had Proteus vulgaris in the preoperative eye and carried the same organism in 12 instances in the nose, in two cases in the throat, and five cases on the skin around the eye.

Elimination of bacteria from the preoperative eye was accomplished in various periods of time depending on the organism. In 507 cases in which Staphylococcus aureus was present without Escherichia coli or Proteus vulgaris, one day sufficed for complete elimination of bacteria from the eyes in 73 patients, two days in 219, four days in 64, and five days in 14. The Escherichia coli and Proteus vulgaris required from three to seven days of treatment for complete elimination.

Antibiotic treatment of the eyes resulted in only a temporary suppression of potential pathogens. A series of 41 patients of the 567 comprising Group 4 of Table 1 were followed with daily cultures for a week after the operation. These patients were chosen to include 12 who also had shown either Escherichia coli or Proteus vulgaris in the operated eye previous to antibiotic prophylactic treatment. From this limited study it was found that in 29 of these cases, Staphylococcus aureus, or gram-negative organisms, or both had returned to the nonoperated eye in 24 hours, while in the 12 remaining cases, two to seven days passed before the organism was again recovered. The longer lag period before return of the potential pathogens was seen in the cases in which no areas of infection contiguous to the eyes were present.

Discussion

A number of investigaors have reported postoperative infections following cataract extractions. In recent years Hughes and Owens[4] stated that in a series of 2,086 operations performed without prophylactic antibiotic treatment, purulent endophthalmitis occurred in 21 cases. After employing prophylactic measures with prolonged treatment, only two cases of postoperative endophthalmitis resulted in 1,200 extractions.

Callahan,[5] in 1953, in a series of 1,653 cataract extractions lost five eyes from endophthalmitis. He believes that delaying the operation for adequate antibiotic treatment has reduced the number of infections in his series and may prevent future cases

TABLE 5

THE EXTRAOCULAR OCCURRENCE OF STAPHYLOCOCCUS AUREUS, ESCHERICHIA COLI, AND PROTEUS VULGARIS IN THE 567 CASES IN WHICH THE OPERATION WAS DEFERRED FOR LOCAL SUPPLEMENTARY TREATMENT WITH ANTIBIOTICS: NUMBER OF DAYS REQUIRED FOR COMPLETE ELIMINATION OF BACTERIA

Number of Operations	Preoperative Culture Organisms Isolated*	Nose Culture	Throat Culture	Culture of Skin around Eye	Number of Days Required for Elimination of Bacteria						
					1	2	3	4	5	6	7
					Number of Cases in Each Day						
507	Staphylococcus aureus	431/505†	131/426	131/426	73	219	137	64	14		
22	Escherichia coli	10/22	3/22	2/22			6	11	5		
38	Proteus vulgaris	12/38	2/38	5/38			7	6	19	4	2

* 549 of the 567 cases had Staphylococcus aureus in both eyes.
† Numerator, number of cultures positive for Staphylococcus aureus and so forth. Denominator, total number of cultures taken.

of endophthalmitis as more specific antibiotics are developed.

Maumenee and Michler[6] have emphasized the possible role of micro-organisms carried on the skin as a source of postoperative eye infection. They recommend the topical application of antibiotics one week before operation and the systemic administration of antibiotics a day prior to operation and several days thereafter.

From the data presented previously,[1] it appeared that if Staphylococcus aureus was present preoperatively, postoperative infections may occur but, when absent in the preoperative cultures, postoperative infections did not occur. The data submitted have shown that the number of postoperative infections in patients known to carry Staphylococcus aureus appears to have diminished following routine administration of five local applications of antibiotics. In a limited group of 567 cases with Staphylococcus aureus and gram-negative organisms present preoperatively in which the operation was delayed for supplementary local treatments with antibiotics, no postoperative infections occurred. It would appear that continued applications of antibiotics until no potential pathogens remain might prevent postoperative infections but a larger series of patients is needed to establish this fact.

Eradication of Staphylococcus aureus from the eye requires constant alertness. The organism rapidly acquires resistance to new antibiotics. This finding is in accord with the reports from numerous investigators. McNeil[7] found 48 percent of staphylococci isolated from a series of 175 patients with chronic external ocular infections were resistant to penicillin. Instances of resistance to aureomycin, terramycin, bacitracin, chloramphenicol, and streptomycin were numerous. The subject has been reviewed by Knight and Collins.[8]

The presence of contiguous areas of infection shortens the period of time during which sterile conditions are maintained in the eye following antibiotic treatment.

Summary

1. The results of preoperative, local application of antibiotics are reported in 7,662 cases of cataract operations performed from 1945 to October, 1955. Six cases of endophthalmitis resulted, five due to Staphylococcus aureus and one due to Escherichia coli. This is a reduction in incidence of infection over the previous 10 years.

2. Postoperative infections were absent in a small series of 567 cases carrying Staphylococcus aureus sometimes in association with E. coli or Proteus vulgaris, when the operation was deferred for supplementary local treatments with antibiotics.

3. The eyelids carried the greater number of Staphylococcus aureus.

4. The incidence of Staphylococcus aureus in ocular cultures obtained before the operations has risen since 1938 from 21 percent to 42.5 percent of patients cultured.

5. The number of strains of Staphylococcus aureus sensitive to penicillin has dropped from 86 percent to 22 percent in the last 10 years and sensitivity to terramycin, chloramphenicol, and streptomycin is declining, necessitating the employment of new antibiotic agents.

6. After local antibiotic treatment the potential pathogens may return to the eye in 24 hours.

635 West 165th Street (32).

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AN EXPLANATION FOR THE POOR PERFORMANCE OF APHAKIC PATIENTS ON THE HARRINGTON-FLOCKS SCREENING TEST*

LOUISE L. SLOAN, PH.D.
Baltimore, Maryland

A device has recently been described by Harrington and Flocks for detecting defects of the visual field within a radius of 25 degrees from fixation. This test employs a series of patterns, composed of dots, lines, or crosses, painted in fluorescent ink on white cards. The patterns are invisible in ordinary light, but fluoresce with a greenish color during exposure to light from an ultraviolet lamp. The authors of the test recommended that the room illumination be sufficient to provide about six foot-candles on the test cards. Since these have a reflectance of about 80 percent, their luminance (surface brightness) is about 4.8 ml. when the incident illumination is six foot-candles. The added ultraviolet light is exposed in flashes lasting a quarter of a second. Because of the brief interval of visibility of the test patterns the patient does not have time to shift his gaze from the central fixation target.

According to Harrington and Flocks,[1] aphakic patients, with normal visual fields when examined by standard methods, "respond as though they had a visual field loss" when tested with the patterns activated by ultraviolet light. In the discussion following their paper, Flocks attributed the poor performance of aphakic patients to optical factors associated with the high power of the spectacles.

The strong convex lens commonly required to correct the aphakic eye is undoubtedly partly responsible for apparent constriction of the visual field. There are at least three ways in which optical factors may affect the visibility of the targets of the Harrington-Flocks test:

a. If the patient does not have separate glasses for distance and for near vision and wears bifocals during the test, he is undercorrected by about three diopters for all but a few locations of the test targets. It is usually not feasible to have him wear his near correction in a trial frame because the frame itself may obscure vision of objects in the paracentral field.

b. Peripheral aberrations produce a reduction in visibility of test targets at some distance from the optic axis of the lens.

c. The apparent location of targets 20 de-

* From the Wilmer Institute of The Johns Hopkins University and Hospital. This investigation was supported by Grant B-810, from the National Institutes of Neurological Diseases and Blindness, Public Health Service.

grees and 25 degrees from the fixation point show a significant outward shift because of the induced prism power of the strong convex lens. The smaller targets in this area may therefore fall outside the limits of the field of the corrected aphakic eye. Since these optical effects are all present when the visual field of the aphakic is determined by standard procedures, they cannot be responsible for the more marked field defects shown by aphakic patients in the Harrington-Flocks test than in studies of the central field on a conventional tangent screen.

A factor present only in the Harrington-Flocks test is the ultraviolet light reflected from the white test card. The lamp used in this instrument has a maximal emission at 365 mμ. Wald[2] has shown that the near ultraviolet between about 300 and 400 mμ is transmitted by the cornea and absorbed by the lens of the eye. "As a result," he says, "lensless persons see very well in the near ultraviolet. At 365 mμ their sensitivity on the average is almost 1,000 times as great as that of normal observers." Ultraviolet light reflected from the white background on which the test patterns appear, if it reached the retina, would be perceived as blue and could reduce the visibility of the patterns not only by decreasing the brightness contrast, but perhaps also by decreasing the color contrast between the greenish test pattern and its surroundings.

The purpose of the present study was to investigate experimentally the importance of this factor as compared with the optical factors previously discussed.

Experimental studies of the influence of ultraviolet light

To investigate by direct experiments the role of ultraviolet light in reducing the visibility of the test targets we employed a Wratten Gelatin Filter No. 2A, mounted between two pieces of clear plastic. This filter absorbs all radiations below 400 mμ but has a low absorption of light in the visible spectrum. To the normal eye with a lens,

TABLE 1

Number of targets seen by aphakic patients with and without filter which absorbs ultraviolet

Case No. and Age	Glasses Worn	Number of Targets Seen With Filter	Without Filter
1. 25 yr.	R +12.25D. sph. L +12.25D. sph. +2.0D. cyl. ax. 55° + 3.0D. add.	30 30	0 0
2.	R +7.25D. sph. +1.0D. cyl. ax. 20° L +7.0D. sph. +3.0D. add.	27, 30 22	1, 2 1
3.	R +11.0D. sph. +1.5D. cyl. ax. 180° + 3.0D. add.	26	2
4. 79 yr.	R +11.0D. sph. +2.0D. cyl. ax. 180° + 3.00D. add.	28	10
6. 65 yr.	R +12.0D. sph. +0.75D. cyl. ax. 135° L +11.75D. sph. +0.75D. cyl. ax. 175° + 3.0D. add.	Tested Binocularly 19	0
7.	R +12.5D. sph. +0.75D. cyl. ax. 180° + 3.0D. add.	9	0
8.	L Refractive correction not recorded	18	0

the test cards in continuous illumination from the ultraviolet source alone appear essentially the same with and without the filter before the eye. This would be expected because the ultraviolet light does not reach the retina in either case. To the aphakic patient on the other hand the test cards in ultraviolet light appear bluer and brighter when the filter is suddenly removed. Ten aphakic eyes, without other ocular defects, were examined on the Harrington-Flocks instrument, first with the ultraviolet-absorbing filter before the eye and secondly without it. In both instances the patients wore bifocal spectacles. An overhead Mazda light provided a steady illumination of 1.9 foot-candles on the test cards.*

On the 10 test cards a total of 30 targets are seen by the normal eye. Table 1 gives the number seen by the aphakic eyes in tests made with and without the filter. When the filter was used, there was in every instance a significant increase in the number of targets seen. Since the test was given first with the filter, the improvement in performance cannot be attributed to practice. Without the filter there was only one instance in which more than two of the 30 targets were seen. Those who missed all of them reported that, on each test card, they saw only a general flash of bluish light covering the entire test field.

Failure to see some of the targets when the filter was used can probably be attributed chiefly to the optical factors discussed previously. With the filter Case 5, for example, was unable to see the four dots of plate 8 located close to the fixation point but, when he raised his glasses so that this area of the field was seen through the reading portion, all four dots were perceived. Case 3, who missed only four of the 30 test targets, saw more than were actually present when the targets were close to the fixation point. This may have been the result of a monocular diplopia introduced by the bifocal. The targets most frequently missed by all patients when the ultraviolet absorbing filter was used were the dots at 20 degrees and 25 degrees from fixation in the upper field. The targets located in corresponding areas of the lower field were seen more frequently, probably because the light from these passed through the reading segment of the patient's glasses.

* In preliminary studies it was found that when an illumination of six foot-candles as recommended by Harrington and Flocks was used, many normal eyes were unable to perceive some of the test targets. The lower illumination of 1.9 foot-candles resulted in fewer incorrect responses from subjects whose visual fields were normal by conventional tests.

Summary and Conclusions

1. The poor performance of aphakic patients on the Harrington-Flocks test is partly accounted for by optical effects associated with correction of their high errors of refraction. Blurring of the retinal images and their outward displacement may both contribute to a reduction in visibility of the targets.

2. Of much greater importance than these optical factors is the fact that ultraviolet light reaches the retina of the aphakic eye and reduces the contrast between the test target and its background.

3. The effect of ultraviolet light was demonstrated experimentally by testing 10 aphakic eyes with and without a filter which prevented such light from reaching the retina.

The Johns Hopkins Hospital (5).

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THE PERICYTES OF THE CHOROID OF THE HUMAN EYE*

J. Reimer Wolter, M.D.
Ann Arbor, Michigan

Introduction

The cell elements known as pericytes were discovered by Rouget[1] in the capillaries of the membrana hyaloidea of the frog. Zimmermann[2] in his fundamental contribution described in detail the morphology of these remarkable cells of the capillary wall in numerous organs of man and in several species of animals, but did not mention those of the eye. Schaly[3] studied the pericytes of the choroid but his description and illustrations convey very little information. In this contribution the results of our studies of the pericytes of the human choroid with a silver technique are presented and microphotographic evidence is submitted which is so far not available in the literature.

Material and Method

Tissue of normal human eyes fixed either in Cajal's solution (bromformol) or in formalin was exclusively utilized. Frozen sections of the choroid were then treated by the modified silver staining technique of Gros-Schultze described at the end of this paper.

Histologic description

There are two muscle layers in the larger arteries of the human choroid—the inner circular and the outer longitudinal (fig. 1). In the smaller arteries of the inner part of the choroid the muscularis is much thinner and the pattern of its fibers becomes irregular, incomplete, and with numerous gaps in the longitudinal layer. In the smallest arteries there is only one layer of very irregularly spaced muscle fibers (fig. 2). While the muscle fibers of the larger arteries are usually spindle-shaped, those of the smallest arteries are irregular in form and may branch (fig. 2).

The precapillaries, capillaries, and the postcapillary veins of the choroid possess no muscle fibers; these are replaced by special cells—*the pericytes*. The fundamental type of these elements is a flat polymorphic cell with branching processes and a centrally placed, small, elongated nucleus. They are closely attached to the vessel wall from which they may easily be distinguished by their bizarre appearance (figs. 3 to 8).

Morphologically the pericytes (1) of the larger precapillaries, (2) of the smaller precapillaries and capillaries, and (3) of the postcapillary veins of the choroid are decidedly different.

1. *The largest pericytes* surround the coarser precapillaries with their branched processes (fig. 3). Pericytes of this type are loosely arranged and are not interconnected; the nucleus is placed in the central part of the body of the cell which has numerous branching processes. These processes are long enough to encircle the vessels.

2. *The pericytes of the more delicate* precapillaries (before junction with the capillaries) are smaller, more star-shaped, and form a dense network which is also closely attached to the vessel wall (fig. 4).

Pericytes of a type similar to that of the smaller precapillary vessels are also regularly present on the capillaries. However, we observed distinct differences in shape and arrangement of the pericytes of the choriocapillaris in different clinically normal eyes.

Figure 5 represents an area of a flat section of the choriocapillaris of a normal eye; the silver impregnation stained only the pericytes, the processes of which form a dense interconnected network surrounding the capillaries.

Figure 6 shows two areas of the chorio-

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Fig. 1 (Wolter). Muscle fibers of a large artery of the human choroid. (a) Fibers of the outer longitudinal layer, (b) Fibers of the inner circular layer. (Photomicrograph, modified Gros-Schultze method, ×500.)

capillaris of another normal eye with scattered clumsy pericytes attached to the wall of capillaries.

Figure 7 shows an area of the choriocapillaris of a third normal eye with pericytes which are similar in shape to those demonstrated in Figure 5—but more scattered. Figures 6 and 7 convey the impression that the pericytes are not placed on the wall of a capillary but, in reality, they are firmly

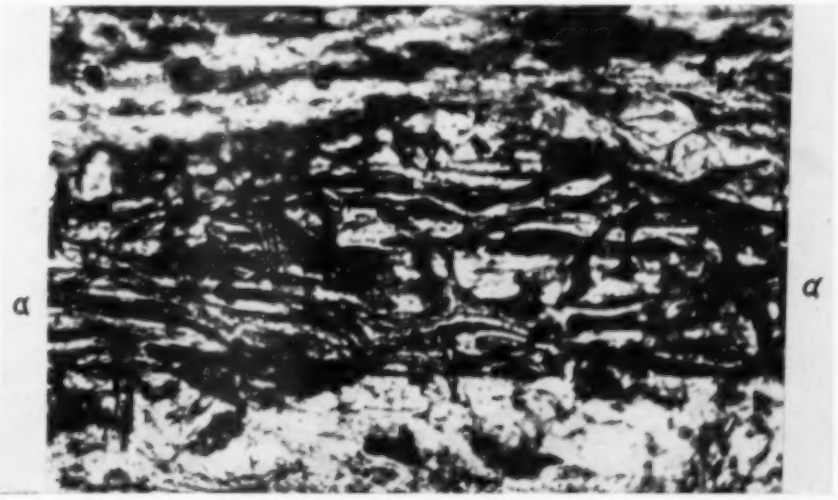

Fig. 2 (Wolter). Small artery of human choroid (a-a) with only one layer of irregularly formed and branching muscle fibers. (Photomicrograph, modified Gros-Schultze method, ×500.)

Fig. 3 (Wolter). Larger precapillary vessel of human choroid (a-a) with a typical pericyte which embraces the entire vessel with long bizarre processes. A large process of the cell is visible on the opposite wall of the vessel (left side of pericyte in picture). (Photomicrograph, modified Gros-Schultze method, ×500.)

attached to it; however, the outlines of the capillaries are barely visible in the sections and do not appear in the microphotographs.

3. *The postcapillary veins* carry a third type of pericytes which differ greatly from those described above. These pericytes are distinguished by a very slender body with a small elongated nucleus and numerous long processes which embrace or ring the circumference of the vessels (fig. 8). Many of

Fig. 4 (Wolter). More delicate precapillary vessel of human choroid (a-a) surrounded by the dense network of the smaller, star-shaped type of pericytes. Arrows indicate wall of the vessel. (Photomicrograph, modified Gros-Schultze method, ×500.)

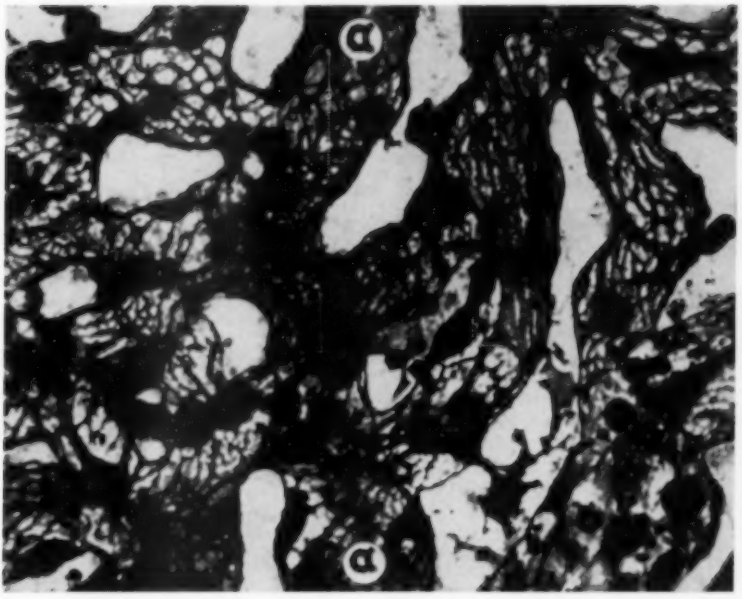

Fig. 5 (Wolter). Flat section of human choriocapillaris showing the network of capillaries. The latter are covered by numerous interconnected pericytes. (a) Capillaries. (Photomicrograph, modified Gros-Schultze method, ×700.)

these processes branch and rebranch at right angles and are interconnected. While some of them encircle the vessels, others run longitudinally on the vessel wall. These elements also form a loosely arranged network.

Those areas of the vessel wall which do not carry pericytes frequently are covered by the processes of the melanoblasts of the intervascular space of the choroid (Wolter).[4]

We could trace no pericytes on the veins of larger caliber.

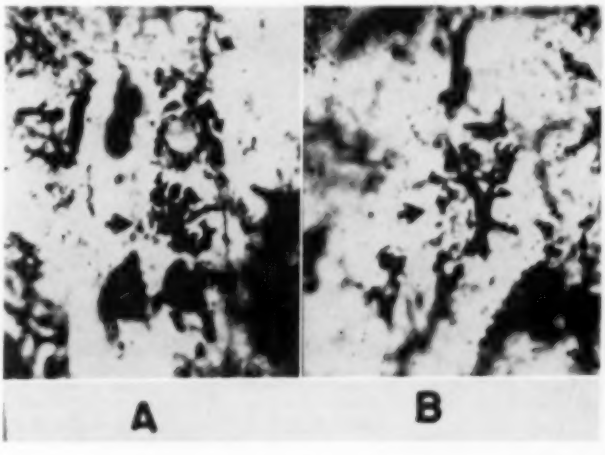

Fig. 6 (Wolter). (A and B). Two pictures of human choriocapillaris with two clumsy pericytes on capillaries (arrows). The walls of the capillaries do not appear in the photomicrographs. Granulated pigment of the pigmented epithelium of the retina is visible at the right side of the pictures indicating the localization of the pericytes. (Photomicrographs, modified Gros-Schultze method, ×700.)

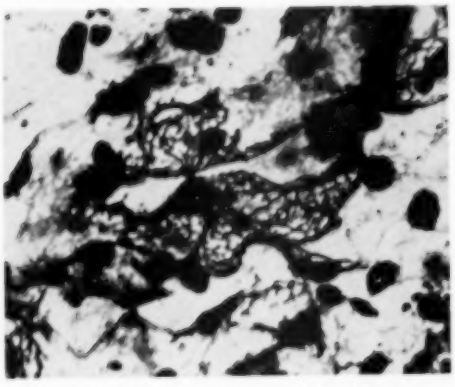

Fig. 7 (Wolter). Pericytes with delicate, networklike processes on the wall of vessels of human choriocapillaris. (Photomicrograph, modified Gros-Schultze method, ×700.)

Discussion

These findings are completely in agreement with Zimmermann[2] who described the pericytes in man and animals and emphasized that these cells are peculiar only to the precapillaries, capillaries, and postcapillary veins. He was not able to find pericytes among the muscle fibers of larger vessels, which is also the case in the choroid. Zimmermann also pointed out that pericytes in various human organs and on vessels of different caliber are morphologically different; this is also true for the pericytes of the human choroid. The morphologic differences of pericytes in various organs is also confirmed by Scharenberg (personal communication) who was able to demonstrate pericytes peculiar to the vessels of human cerebellum, and by our findings in the human retina (unpublished).

The morphologic differences in pericytes of the capillaries of different clinically normal eyes as described above could possibly be considered as functional or abnormal details. However, our knowledge of the nature of pericytes is still very limited and our histologic observations are not yet sufficient to understand this fact.

The nature, the possibly muscular character, and the physiologic significance of the pericytes have been occasionally discussed in the literature (Rouget,[1] Zimmermann,[2] Schaly,[3] Wolfrum,[5] Bargmann[6]) but still remain in doubt. Koelliker[7] noted that the smooth muscle fibers are not always spindle-

Fig. 8 (Wolter). Postcapillary vein of human choroid (a-a) with loosely arranged pericytes which are peculiar to this type of capillaries. Long processes of the pericytes ring the vessel. Arrows indicate wall of postcapillary vein. (Photomicrograph, modified Gros-Schultze method, ×500.)

shaped and may branch; this we can confirm (fig. 2). However, we were unable to demonstrate true transitional forms between smooth muscle fibers and pericytes. We believe that further histologic, pathologic, and physiologic studies of the pericytes of the human eye are important since these intricate cells on the wall of capillaries might prove to be the element which is responsible for the control of the flow of blood in the capillaries of choroid and retina—and for contractions of capillaries under pathologic conditions.

Summary

Impregnation with a modified silver nitrate method of Gros-Schultze shows three different types of pericytes on the precapillaries, capillaries, and postcapillary veins of the human choroid. Microphotographic evidence is submitted.

University Hospital.

Technical Notes

Modified silver nitrate technique of Gros-Schultze (compare Wolter[5, 8]):

1. Fixation of tissue in bromformol (Cajal-solution) or in 10-percent solution of neutral formalin 24 hours or longer.
2. Frozen sections 10-15 are washed in distilled water for two hours.
3. Place sections in pure pyridine for 24 hours.
4. Transfer sections without washing into 10-percent solution of silver nitrate protected from light, until sections turn light brown.
5. Place sections (one at a time) in 10-percent formalin solution for one minute.
6. Place sections (one at a time) in ammoniacal solution of 10-percent silver nitrate for 10 to 20 seconds. The ammoniacal silver solution is prepared in the following manner: Concentrated ammonia is added (drop by drop, stir) to a 10-percent solution of silver nitrate until precipitations are dissolved. Use a small amount of this solution for one section only.
7. Wash in distilled water—50 cc.—and five drops of ammonia.
8. Tone in 0.2-percent solution of gold chloride.
9. Fixation in 5.0-percent solution of sodium thiosulfite.
10. Wash carefully.
11. Mount.

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PRIMARY EPITHELIAL TUMORS OF THE LACRIMAL GLAND

D. F. Milam, Jr., M.D.*
Boston, Massachusetts
AND
Parker Heath, M.D.†
Sullivan Harbor, Maine

Introduction

Disease of the lacrimal gland is rare. By virtue of its location it is largely protected from trauma and infection. Neoplasms are among the most common of the diseases of the lacrimal gland and the most common cause of recognizable chronic lacrimal gland swelling.[11] Because of the rarity of these tumors, only a few authors[2,4,8] have been able to study adequately a significant series of cases. This report of 29 cases from one region is presented primarily to correlate the clinical course with histopathology and to emphasize the poor prognosis of these neoplasms.

Normal lacrimal gland

The lacrimal gland is a tubular racemose gland[12] whose lobules consist of excretory tubules and secreting acini. Two type of cells are found inside the basement membrane of the acini, flat, basal, contractile, myoepithelial, and cylindric secreting cells. The latter are mostly of the serous type, though some mucous secreting cells occur. Sheldon (1943)[8] has called attention to the presence of myo-epithelial cells (also described by Verhoeff in mixed tumors of the lacrimal gland) and emphasized their importance in the formation of the various types of tumors of the salivary glands. These cells possess morphologic features and staining properties similar to those of smooth muscle.

Historical review

Warthin (1901)[1] presented the first adequate survey of these tumors. Because of similarities between the new growths of parotid and lacrimal glands, the latter were also designated "mixed tumors." He reviewed the literature, finding 132 cases; the great majority of these he considered to be mixed tumors of endothelial origin. Verhoeff (1905)[2] presented five cases with histologic descriptions. He believed these tumors to be of epithelial origin from embryonal anlages of the lacrimal gland, and the different histologic types were felt to be of fundamentally the same nature. Sanders (1939)[4] presented 12 cases with adequate clinical follow-up and pointed out the lethal nature of the lacrimal gland tumors. Godtfredsen (1948)[8] with 10 cases correlated the mucous and salivary gland tumors of the lacrimal gland with extraorbital mucous and salivary gland tumors. He concluded these tumors to be histologically and biologically similar. This series coming from the same hospital, with uniform follow-up and histopathologic appraisal, is of great value.

Histogenesis

Mixed tumors of extraorbital origin are more common than those of lacrimal gland origin and have been extensively studied. Hellwig (1945)[7] in a well-documented paper presented a lucid review of the recent concept of these tumors. Willis (1948)[13] makes a detailed analysis of their nature. Salivary gland tumors are now generally considered to be of epithelial origin. They may arise from the adult glandular epithelium, from embryonal anlages of the salivary glands, or possibly from cells derived from the fetal notochord. The myxochondroid stroma of these tumors is formed by the secretions of the tumor cells with probable subsequent in-

* Recent resident in ophthalmology, Massachusetts Eye and Ear Infirmary.
† Consultant of the Eye Pathology Laboratory, Massachusetts Eye and Ear Infirmary.

crease and degeneration of the connective tissue stroma. Tumor cells isolated in this matrix have a pseudocartilagenous or pseudomyxomatous appearance; however, close inspection will show no periosteum or perichondrium in these structures. True cartilage or bone may rarely arise from metaplasia of connective tissue stroma.

These tumors show no age or sex incidence and are usually slow growing. The great majority (about 90 percent) of such tumors are found in the parotid gland, but they also occur in the submaxillary and sublingual glands, the palate, nasopharynx, nose, sinuses, and lacrimal sac.[11] No relation to antecedent disease has been demonstrated.

Classification

The classification of primary epithelial tumors of the lacrimal and salivary glands has been the subject of much debate. For a detailed discussion the reader is referred to the excellent chapter by Willis (1948)[13] on this subject.

Verhoeff (1905)[2] believed these tumors to be of fundamentally the same nature, their structural differences being mainly of degree. He considered it advisable to retain the name, mixed tumor. Certain types were described as cylindroma due to their structure; others as fibromyxoma or sarcoma types of mixed tumors.

Sheldon (1943)[6] by microscopic examination distinguished four intimately related and overlapping groups among these tumors. They were regarded as variations of the type of neoplasm commonly called "mixed tumors." The four categories were: adenoma, "mixed tumor," "myo-epithelioma," and carcinoma.

Willis (1948)[13] considered the distinction between adenomas, carcinomas, and the so-called "mixed tumor" to be an artificial one. All of the categories are variations of types of epithelial tumors with wide range of structure and behavior merging insensibly with the simple adenomas on one hand and anaplastic carcinomas on the other. It was felt to be convenient to continue using these names for descriptive purposes, understanding that they denote not distinct classes of tumors, but variants of a single histogenetic

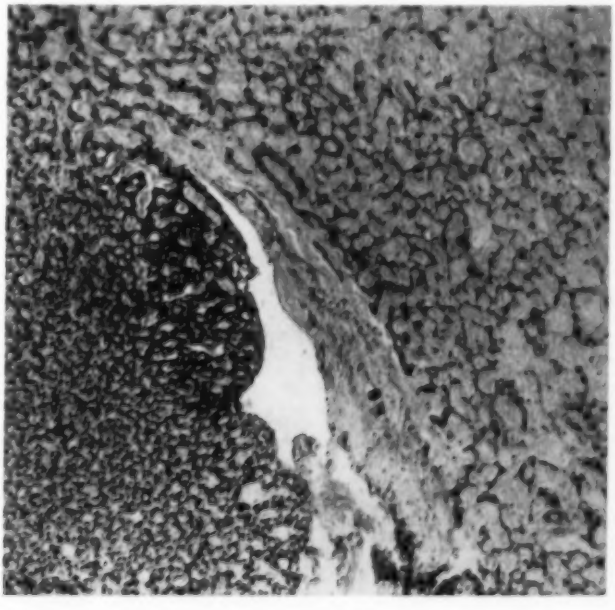

Fig. 1 (Milam and Heath). Case 3. Fibro-myxoepithelioma. Area showing two types of cells present (×190).

group. By designating these tumors as pleomorphic adenomas and adenocarcinomas, the variable structure and behavior of tumors, ranging from benign adenomas to malignant adenocarcinomas and merging into anaplastic carcinomas, were expressed.

Godtfredsen (1948)[8] classified his cases into two main histopathologic types: the fibro-myxo-epithelioma and the basaloma, the latter group because of morphologic resemblances to the cystic and solid types of basal-cell epitheliomas. Transitional forms, as well as different phases within one tumor, were noted to occur. Cystic and solid forms of basaloma were noted. The cystic forms were also called cylindromas. The solid forms had minimal or absent cavity formation.

Duke-Elder (1952)[11] considered that the various epithelial tumor types were probably variants in a single series and used the designation, pleomorphic adenoma and adenocarcinoma, in the same sense as Willis (1948).[13] The great majority (about 90 percent) of lacrimal gland tumors were in this category.

By reviewing microscopic sections of our material we found that histopathologic features correlated well with the clinical courses taken by the patients. In addition with certain patients marked variations were found between different areas of the same tumor as seen in primary material and that from recurrences. Several observers reviewing the same slides independently reached essentially the same classifications. This is presented in tabular form.

PRIMARY EPITHELIAL TUMORS OF THE LACRIMAL GLAND

(Pleomorphic adenomas and adenocarcinomas, mixed tumors of the lacrimal gland)

I. Benign

A. Simple adenomas

II. Malignant

A. Fibro-myxo-epitheliomas (Godtfredsen) (Sheldon restricted the term "mixed tumor" to this group). Figures 1, 2, and 4.

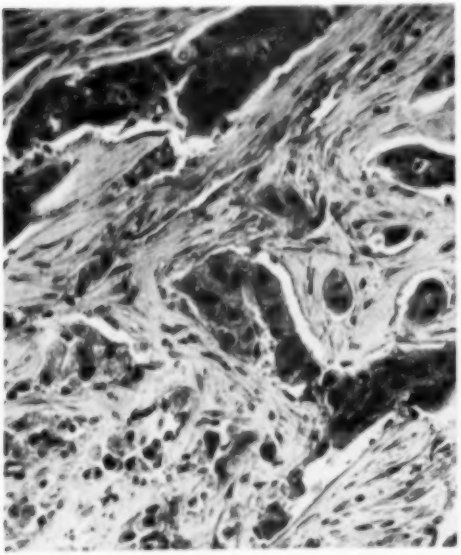

Fig. 2 (Milam and Heath). Case 3. Anaplastic recurrence (×190).

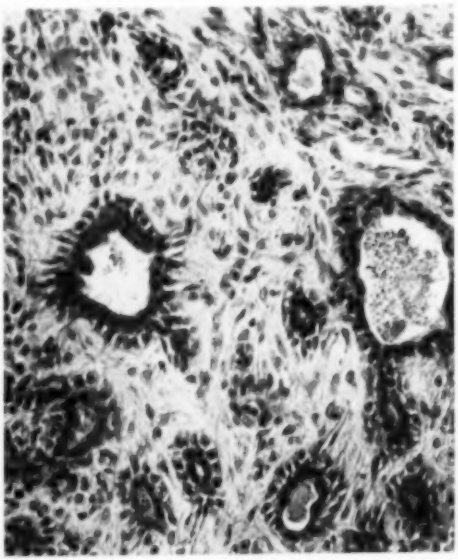

Fig. 3 (Milam and Heath). Case 16. Cystic basaloma with area myxomatous change (×190).

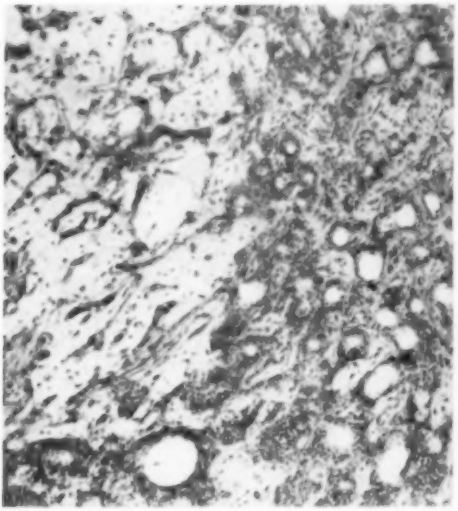

Fig. 4 (Milam and Heath). Case 2. Fibro-myxo-epithelioma showing typical stroma (×190).

B. Basalomas
   1. Cystic (called cylindromas by some). Figures 3, 5, and 6
   2. Solid. Figure 7
C. Other carcinomas
   1. Adenocarcinomas. Figure 10

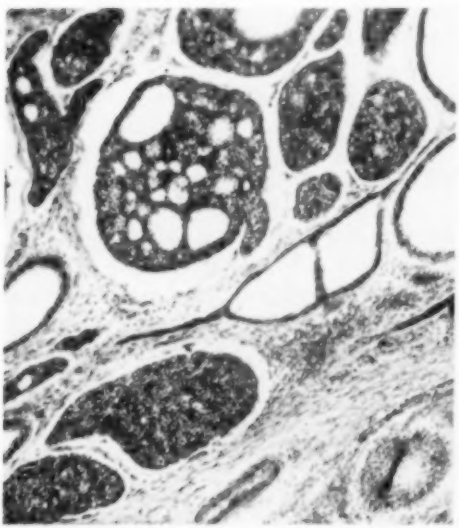

Fig. 5 (Milam and Heath). Case 18. Cystic basaloma showing various sized acini (×190).

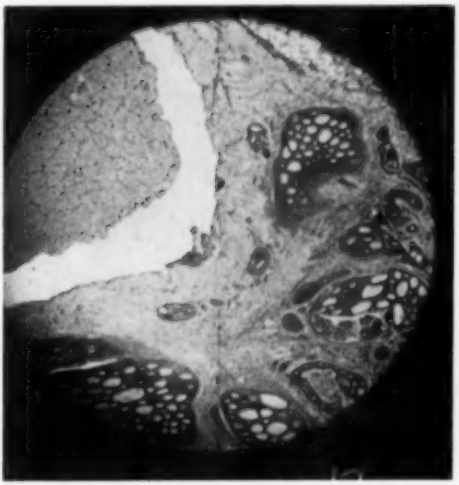

Fig. 6 (Milam and Heath). Case 18. Cystic basaloma invading optic nerve sheath.

   2. Squamous-cell carcinomas. Figures 8 and 9
   3. Undifferentiated carcinomas. Figure 11
      (Anaplastic carcinomas)

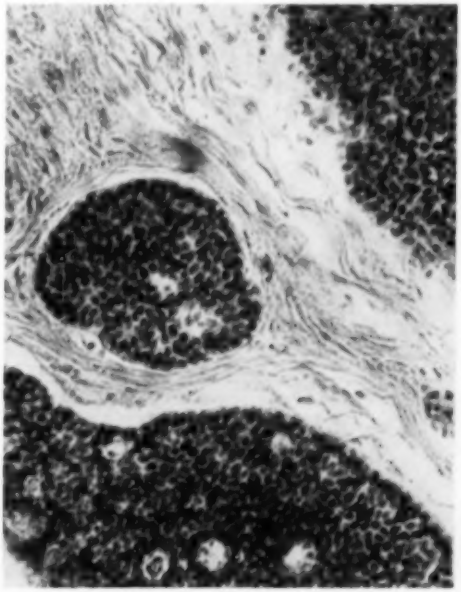

Fig. 7 (Milam and Heath). Case 23. Basaloma "solid type" showing small acini.

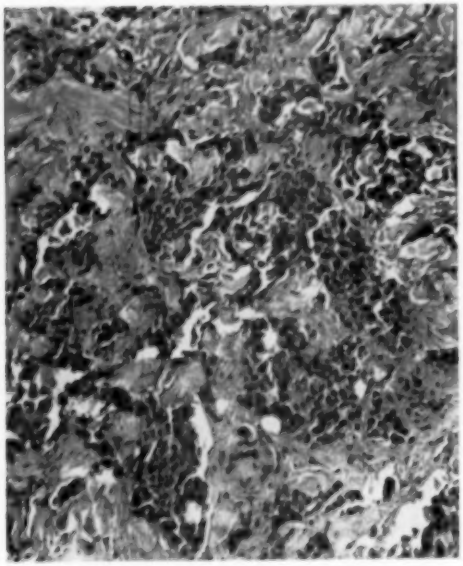

Fig. 8 (Milam and Heath). Case 26. Squamous-cell type carcinoma.

By simple adenoma is meant a uniform proliferation of the normal structure of the lacrimal gland. Any areas within the tumor showing the structure of a fibro-myxo-epi-

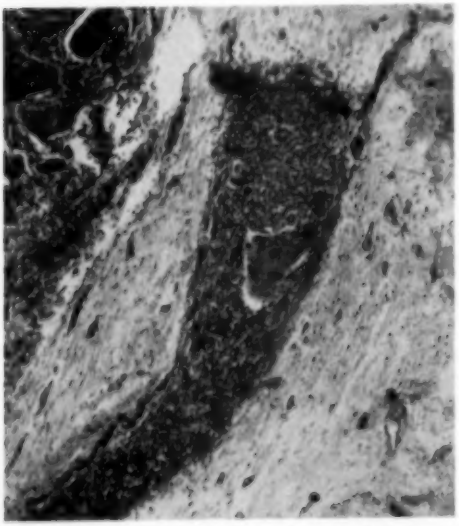

Fig. 9 (Milam and Heath). Case 24. Squamous-cell type with marked chronic inflammatory response.

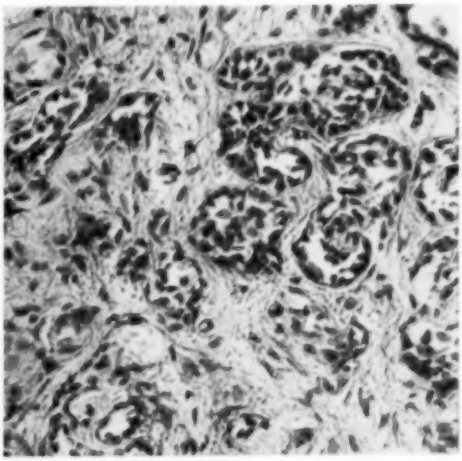

Fig. 10 (Milam and Heath). Case 29. Adenocarcinoma.

thelium should be so classified. Such simple benign adenomas are exceedingly rare. Microscopic slides of one "tumor" from a 79-year-old white man were available which could be classified adenoma; however, insufficient evidence was available to rule out a normal lacrimal gland.

The second group classified here as fibro-myxo-epithelioma corresponds to Sheldon's (1943) second group for which he reserved the term "mixed tumor." The growth is usually composed of lobules of varying size with an apparent connective tissue capsule. Tumor cells may be predominant or sparse. Two types of tumor cells can usually be distinguished, one apparently derived from the epithelial cells of the lacrimal gland, the other from the myoepithelium. These neoplasms frequently present the peculiar mucoid stroma which has earned the name of mixed tumor. Areas of squamous metaplasia with prickle cells and epithelial pearl formation are sometimes found. True cartilage or bone may arise by metaplasia of the connective tissue elements.

The third group designated here, basaloma (Godtfredsen), because of histologic resemblances to basal-cell carcinomas of the skin, is divided into two subgroups, cystic

TABLE 1

SEX AND INCIDENCE

	Sex		Side		*Incidence by Decades							
	M	F	R	L	1	2	3	4	5	6	7	8
Fibro-myxo-epitheliomas	6	9	11	4	0	2	4	2	2	1	4	0
Basalomas	4	4	7	1	0	0	2	3	1	1	0	1
Various carcinomas	4	2	3	3	1	1	0	1	0	0	2	1
Totals	14	15	21	8	1	3	6	6	3	2	6	2

* Age first seen.
Race: All white except for one Negress.

and solid. The cystic form (called cylindromas in the past) have well-developed acini surrounded by one to many layers of cells. The solid forms are richer in cells and small cystic spaces are inconspicuous. Some of the latter show endothelial-lined blood sinuses inside the tumor strands. The tumor cells in both these groups are small, homogeneous, and show relatively few mitoses. The nucleus is usually round and vesicular, the cytoplasm scant and basophilic.

The last group we have classified as "other carcinomas." This includes various adeno- and squamous-cell types and undifferentiated carcinomas. The relationship of this group of the fibro-myxo-epithelioma variety is shown by recurrences appearing as undifferentiated carcinomas. As stated clearly by Willis (1948), the groups just outlined are not distinct classes of tumors but variants of a single histogenetic group.

The material from our series falls into three groups:

1. Epitheliomas with fibrous and myxomatous (mixed) changes.

2. Epitheliomas rich in cells with imitative basal-cell arrangement and either with few or with many cysts.

3. Undifferentiated carcinomas.

In contrasting innocence and malignancy, Willis typified a malignant tumor as follows: Structure often atypical; differentiation imperfect; growth infiltrative as well as expansive; absence of strict encapsulation; growth usually progressive to fatal outcome; metastasis frequently present; intrinsically dangerous because of progressive infiltrative growth and metastasis. By these criteria *all* of the cases studied in this series are to be considered malignant. The dismal outcomes found through follow-up justify this conclusion. We believe the tendency to state from histologic evidence that a particular tumor is benign is dangerous and unjustified for the kind of neoplasm we are considering.

MATERIAL

Thirty-seven cases diagnosed as primary epithelial tumors were found in the files of the Eye Pathology Laboratory over a 60-year period. Four were eliminated as no clinical record was available. Two examples of Mikulicz disease and two other cases of inflammatory reactions of the lacrimal gland were eliminated. The differential diagnosis[14] of this latter group is most important when considering surgical treatment. Twenty-nine cases were found suitable for study.

The 29 cases were all malignant primary epithelial tumors of the lacrimal gland. Fifteen of these were classified as fibro-myxo-epithelioma, eight as basalomas, six as various other forms of carcinomas. Complete follow-up was possible with 25 patients.

STATISTICAL SURVEY (See Tables 1 and 2.)

The age when first seen ranged from 18 months to 75 years. The peak of incidence generally was in the third and fourth decades. The right orbit was more involved than the left (21/8). Almost equal numbers of either sex were afflicted. The most common presenting complaints were in order—

TABLE 2

SUMMARY OF DATA

Case No.	Name, Number P = Path, # = Hosp.	Race	Sex	Age	Side	Initial Symptoms (Duration, yr.)	Initial Treatment
				A. FIBRO-MYXO-EPITHELIOMA			
1	Mary P., P-174	W	F	26	L	Exophthalmos 2 yr.	Biopsy-normal lacrimal gland
2	Laurence N. P4840	W	M	17	L	Exophthalmos 1½ yr.	Local removal
3	Dr. Jack's case P-1518	W	M	38	L	Poor vision 15 yr. Exophthalmos 9 yr.	Growth shelled out
4	Joseph Z. P-1765	W	M	49	R	Exophthalmost 3–4 yr. Pain in orbit 10 yr.	Local removal, exenteration
5	John R. P-6770	W	M	30	R	Inflammation 2 yr. Exophthalmos 1 yr.	Local removal; radium therapy
6	Anna G. P-5044	W	F	64	R	Tumor U.L. OD Ptosis app. 5 yr.	Partial removal; radium
7	Ester E. P-8358	W	F	27	R	Slowly increasing exophthalmos	Tumor shelled out
8	Louise G. 63984	W	F	20	R	Swelling above OD 5 yr. Blurred vision 2 yr.	Tumor shelled out
9	Leo G. 473086	W	M	13	L	Exophthalmos 1½ yr. Dyplopia	Local removal
10	Winifred J. 623751	C	F	28	R	Exophthalmos 2 wk.	Biopsy—normal lacrimal gland 3 m. transfrontal craniotomy
11	Verda, G., 742142	W	F	63	R	Exophthalmos 6 mo.	Biopsy and exenteration
12	James H. 477308	W	M	57	R	Exophthalmos 1 yr.	Biopsy and exenteration
13	Sara W. P-10262	W	F	60	R	Exophthalmos 6 yr.	Tumor shelled out
14	Alice Y, P-9918	W	F	64	R	Growth UL 12 yr.	Partial local excision
15	Eugenie C. 78195	W	F	45	R	Exophthalmos 2 yr.	Biopsy; local excision
				B. BASALIOMA			
				Cystic			
16	Kate B. P-342	W	F	31	R	Exophthalmos 2 yr.	Local excision
17	Hugh D. P-1021	W	M	29	R	Exophthalmos 2 yr.	Local excision
18	Peter S. P-3785	W	M	57	R	Diplopia 3 yr. Failure vision 2 yr.	Exenteration
19	Ignatius S. 419608	W	M	75	R	Tumor Orbit OD 2 yr.	Exenteration orbit
				Solid			
20	Doris C. 53819	W	F	25	R	Ptosis 2 yr. Exophthalmos 3 mo.	Partial local removal
21	Isabel B. 430866	W	F	38	R	Swelling UL 9 mo.	Exenteration
22	Laurence P. 689037	W	M	45	R	Ptosis 3 mo. epiphora 3 mo.	Biopsy—normal lacrimal gland 6 mo. later exenteration
23	Frances G. P-11322	W	F	38	L	Ptosis 3 mo. Exophthalmos 1 mo.	Biopsy; 1 yr. later exenteration

TABLE 2 *(continued)*

Case No.	Name, Number P = Path, # = Hosp.	Race	Sex	Age	Side	Initial Symptoms (Duration, yr.)	Initial Treatment
				C. Other Carcinomas			
24	Laura B. P-2538	W	F	69	R	Ptosis 9 mo. Loss vision 9 mo.	Exenteration
25	Frank C. E-59-443	W	M	73	L	Poor vision 2 yr. Exophthalmos 1 mo.	Biopsy; Kronlien
26	Allen B. 734924	W	M	38	R	Exophthalmos 2 yr.	Biopsy; exenteration
27	Walter K. 783110	W	M	62	R	"Tumor Orbit" 5 mo.	Biopsy; exenteration
28	Mary L. 276662	W	F	17	L	Exophthalmos 6 wk.	Biopsy; Kronlien; exenteration
29	John K 845286	W	M	1½	L	OS turned in 15 mo. Mass Orbit 2 wk.	Biopsy; exenteration; recurrence, 3 mo.

Cases 1, 2, 16, 17 reported by Verhoeff (1905).
Case 3 reported by Jack (1910).
Case 2 had follow-up note by Irving (1951).

exophthalmos, ptosis, and loss of vision. Orbital pain was reported by only two when first seen. With three exceptions, a mass was felt in the upper outer quadrant of the orbit. With two, no mass was palpated. A mass was felt below the globe of one case. Considered as a group, the presenting mass was firm, fixed, nontender, smooth to knobby upon palpation. The globe was displaced forward, downward, and nasally in most instances. Limitation of motion up and laterally was the rule. The fundi of four patients showed congestion, blurring of the disc margin; three presented folds of the retina. Initial X-ray studies frequently failed to reveal bone involvement.

The clinical course

Of the 15 cases of fibro-myxo-epithelioma, four were lost to follow-up; three are living without recurrence; two are living with recurrence; two died of their tumor; four died of other causes although three of these were probably due to tumor. The two cases died of their disease 18 and 28 years after the onset of symptoms.* Seven cases had recurrence of their tumor. Recurrence, 10, 11, 26 years after operation was noted, the latter two leading to the patients' death. For this reason, a five-year or even 10-year follow-up is of little significance in this group of tumors. With three patients, the recurrences were histologically more malignant.[3, 9, 13] Regional lymph nodes were involved with two.

The clinical picture of the rich cellular epitheliomas (basaloma group) is very different. Of eight patients, seven died of their tumor, one of epilepsy. Death occurred on the average of four years after the onset of symptoms. The probable causes of death of all cases were intracranial extensions. Lung metastases were reported once.

Of the six cases of other types of carcinoma, three patients died of their tumor in about two and one-half years after the onset of symptoms. Two patients are living with inoperable metastasis. One patient is living without recurrence.

Thus, of the 25 cases completely followed up, 12 certainly and three more then probably died of their disease; five were living

* The first (Case 2, L. N.) had incomplete removal October, 1895. By January, 1897, massive recurrence was treated by exenteration. In 1923, gave six-months history of aching teeth, swelling lid and orbit on involved side. Exenteration and radical sinus operation, X-ray treatments. Died soon after, presumably from disease.

TABLE 3

RECURRENCE, COURSE, THERAPY

Case* No.	Years = Time Since Operation	Final Outcome Follow-up since Last Operation Years since First Seen
1	1 yr. exophthalmos greater partial removal tumor	Lost to follow-up 2 mo. postop.
2	28 yr. exenteration; radical local removal	Died CNS extension 28 yr.
3	1 yr. local excision; spread to regional nodes	Died CNS extension 3 yr.
4		Lost to follow-up
5	10 yr. local, regional nodes	Died "acute endocarditis" 12 yr.
6	Local recurrence	Died 5 yr. ? cause
7		No follow-up
8	11 and 14 yr. local removal; Kronlein	Followed 3 yr. Living without recurrence
9	2, 7, 10 yr. local excision, transfrontal orbital exenteration; local removal incomplete	Followed 4 mo. Living without recurrence
10	No recurrence	Followed 5 yr. Living without recurrence
11	No recurrence	Followed 3 yr. Living without recurrence
12	4½ yr. no recurrence	Died epileptic seizure
13	6 yr. exenteration	Lived 11 yr. Died "cancer of the brain"
14	Followed 18 yr. without recurrence	Living without recurrence
15	Followed 5 yr. without recurrence	Lost to follow-up after 5 yr.
16	1 yr. exenteration	Died intra-cranial extension 4 yr.
17	1 yr. exenteration	Died 3 yr. postop.
18		Died of disease 1 yr. postop.
19		Died 1 yr. postop.? Cause
20	2 mo., 9 mo., 2 yr. local excision exenteration 2 X-radiation	Died of disease 5 yr. with lung metastasis
21	Local	Died 3 mo. postop. of disease
22	9 mo., 18 mo., local, lung metastasis, radiation	Died of disease 2 yr. postop.
23	1 yr.; radiation	Died CNS involvement 4 yr. postop.
24	1 mo., recurrence; X-ray; ? intracranial extension	Died with disease 1 mo. postop.
25	6 mo., 1 yr. local recurrence node; lung metastasis exenteration, X-rays	Died 2½ yr. postop.
26	1 yr., local, lymph node, X-rays	Living 4 yr. postop. with inoperable metastasis
27	8 mo., excision, X-rays	Died of disease 1½ yrs. postop.
28		Living 2½ yr. postop. withour recurrence
29		Living, recurrence 3 mo. after exenteration, palliative X-ray treatment

* Same as in Table 2

without recurrence; three were living with recurrence; four died of other causes. The prognosis for all types is poor, especially for the basaloma group. The survival is less for the solid than cystic forms of the latter. Metastases to lymph nodes were found with five cases, to the lungs with two.

Comment

The poor results from surgery demonstrated here demand some explanation. Godtfredsen (1948) found four of 10 cases dead, one living with recurrence at the time of publication. His period of follow-up was short. Sanders (1939) reported recurrence in 10 of 11 cases; metastasis in four of 12; death from intracranial extension in five of 12. Reese[10] quotes Sanders[4] as reporting 12 cases, 11 cases operated on, one refused treatment. All 11 treated surgically had recurrence. The untreated case and six operative cases died. Two cases were alive without recurrence after further surgery. The above statistics are similar to those reported in this study. Radiation has proved of little value in any published series.[11]

On reviewing the operative procedure used, it is apparent that undue delay and incomplete surgical treatment are very much in evidence. Biopsy was found frequently not to have been followed up for several months. On occasions, normal lacrimal gland tissue was obtained by biopsy and operation delayed until the symptoms and signs had progressed further. The normal lacrimal gland had been pushed ahead by the underlying tumors. The biopsies were insufficient in depth. In some instances tumors were shelled out of a sort of bed and neoplastic tissue obviously left behind. Local excision was incomplete in a number of cases.

The lacrimal gland has no capsule.[12] Situated as it is, direct extension into bone and the intracranial cavity is readily possible.[2] Verhoeff (1905) noted the above and recommended exenteration for recurrence or, if unable, to remove the tumor otherwise.

We feel that careful studies of orbital tumors to rule out granulomas, lymphomas, hemangiomas, metabolic disorders are indicated. X-ray films should be taken to explore bony extension. Deep biopsy with study of stained sections should be done. If the biopsy reveals an epithelial tumor of the lacrimal gland, an orbital exenteration with removal of involved bone, if necessary, should be performed initially. Only by early, thorough, and wide surgical treatment can the dismal results listed herein be improved.

Summary and Conclusions

A series of 29 cases of primary epithelial tumors of the lacrimal gland has been studied. From 25 of these, complete follow-ups were obtainable. Of these, at least 12 (possibly 15) patients died of the disease; three were living with recurrence.

Histopathologic studies and classifications have been made. Our findings are in accord with the concept of Willis (1948).

All of the primary epithelial tumors of the lacrimal gland should be considered clinically malignant.

Suggestions for the surgical management of such cases are made.

243 Charles Street (14).

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STUDIES UPON THE RADIATION CATARACT*

II. Commentary on the Radiation Cataract

Fumio Kandori, M.D.
Yonago City, Japan

There are many clinical descriptions of the radiation cataract. The initial reports were those of Gutmann[1] and Treutler[2] in 1905 on cases occurring in X-ray technicians. The first case induced by treatment was reported by Birch-Hirschfeld[3] in 1908. Careful examinations with the slitlamp were conducted by Rohrschneider,[4] Meesmann,[5] Peter,[6] Milner,[7] Aulamo,[8] Grzedzielski,[25] Leinfelder and Kerr,[9] and Cogan.[15] Many experimental studies upon the radiation cataract have been carried out since those of Tribondeau and Recamier[10] in 1905; the most recent using neutrons were by Cogan and Donaldson.[11] Kitajima,[12] Okujawa,[13] and Kandori[14] in Japan also conducted experimental researches along this line.

Peter[6] and Duke-Elder[28] studied the clinical as well as histologic changes after varying doses of irradiation. According to Peter,[6] the lens showed the same findings after different doses of X ray but the latent period varied from five and one-half months to six years. According to Duke-Elder,[28] the adult lens is less sensitive; though more difficult to bring about, pathologic changes following irradiation are essentially the same. However, findings vary greatly according to the radiation dose.

No description of the relation between the clinical and histologic findings has been published. I have, therefore, systematically carried out research work upon varying doses of radiation and followed the radiation cataract clinically as well as histopathologically with different species of experimental animals.

Materials and Results

1. Experimental animals

a. *Rabbits.* White rabbits, aged three months, were exposed to X rays: 80 kv., added 2 mm. Al, 12 cm. target skin distance, in dose ranges to 600 r to 2,000 r in single exposure and 150 r to 300 r two times weekly, total 10 times (1,500 r to 3,500 r), or 300 r to 500 r weekly, total five times (1,500 r to 2,500 r), in fractionated exposure or 15 r to 100 r daily for 80 to 185 times in the protracted fractionated exposure.

b. *Rats.* White rats, aged one to three months, were exposed. Factors were the same

* From the Department of Ophthalmology, Tottori University. Visiting Fulbright Fellow at the District of Columbia General Hospital. I acknowledge with thanks the assistance of Ronald Atmore Cox, M.D., Professor of Ophthalmology, George Washington University, and Sidney John Glueck, M.D., Department of Ophthalmology, District of Columbia General Hospital.

as for rabbits in single exposures with doses ranging from 600 r to 1,600 r.

c. *Monkeys.* Different ages and sizes; 1,100 r to 2,500 r in single exposures.

One eye only of each experimental animal was irradiated and the other served as a control. I have also employed pigeons but was unable to produce a radiation cataract; before the cataract was induced, the bill was torn away, even when protected.

2. EXPLANATION OF THE RADIATION CATARACT ON THE BASIS OF CLINICAL AND HISTOLOGIC FINDINGS.

a. *Clinical manifestations and histologic findings in rabbits.*

Clinical manifestations of radiation cataracts are divided into five stages:

First stage. After a long incubation, the posterior suture became thick, that is, the suture opacity, which was named by Rohrschneider[4] on slitlamp examination. The anterior suture reveals a slightly curved longitudinal line and the posterior suture shows a line curved perpendicularly to the anterior one. There is a marked individual difference and also the posterior suture becomes thicker and denser with age. The diagnosis of this posterior suture opacity, therefore, is based upon the difference between the control and exposed eyes. On transillumination there was no perceivable opacity.

Microscopic examination of the suture cataract made after the enucleation demonstrated a foamy appearance with enlargement of the projecting granules at the posterior suture; this was difficult to recognize by slitlamp examination (fig. 1).

Second stage. Colored flash stage. There was a round, golden yellowish and markedly reflecting opacity near the posterior pole of the lens—the location of the axes of the posterior suture opacity. This opacity could be seen by the slitlamp illumination only and disappeared on transillumination. The colored flash was termed by Vogt[24] as Farbenschillern (fig. 2). Microscopically, an

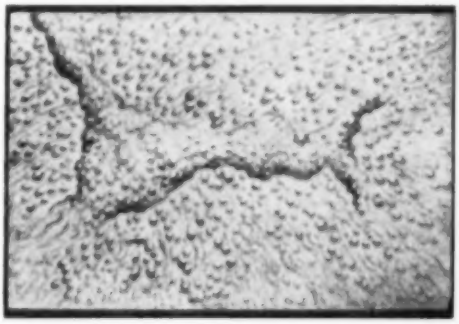

Fig. 1 (Kandori). This photograph shows the posterior suture cataract. It has a foamy appearance due to granular deposits at the posterior suture of the lens (233rd day after irradiation; 1,000 r, single exposure).

enucleated eye showed an elliptically thickening prominence with a granular appearance on its surface. Thickened fibers ran vertically from this opacity in all directions (fig. 3).

Histologic findings of the first and second stages.

The cells which had migrated from the equator of the lens were lined up under the posterior capsule at the pole region. In

Fig. 2 (Kandori). Showing the golden-yellow reflex or colored-flash stage. The opacity in the posterior pole region shows marked reflection properties and can be observed by oblique illumination of the slitlamp but not by transillumination (295th day after irradiation; 1,000 r, single exposure).

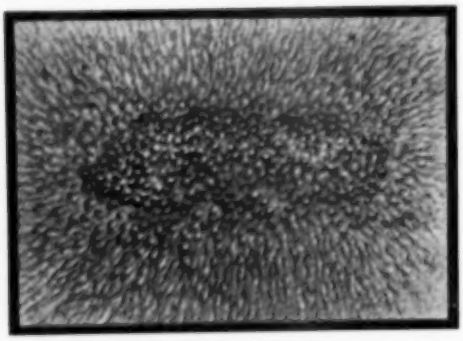

Fig. 3 (Kandori). The colored-flash stage, showing an elliptical elevation of granular deposits in the region of the posterior suture. The thickened lens fibers run radially in all directions to this opacity (247th day after irradiation; 1,000 r, single exposure).

the first stage these cells were along the posterior suture region and, in the second stage, around the posterior suture. The granular appearance was caused by the cells which had migrated under the capsule from epithelium cells at the equator region; these cells had atrophic nuclei with irregular shapes. The cell groups under the posterior capsule were called isolated epithelium by Becker or epithelial island by Wintersteiner (isolierte Epithelzellen nach Becker oder Epithelinseln nach Wintersteinor) (fig. 4).

Fig. 4 (Kandori). An island of isolated cells at the posterior suture at the colored-flash stage. These cells have migrated under the posterior capsule from the epithelium at the equator (rabbit lens, 259 days after first exposure, 250 r, 10 times).

Fig. 5 (Kandori). Rabbit lens irradiated with 1,500 r, single exposure, 255 days previously. There is a tuftlike opacity at the posterior capsule by oblique illumination of the slitlight. Slight opacities, consisting of thickened lens fibers, surround the thick one.

The third stage. The golden yellow opacity of the lens had gradually changed into a dishlike or tuftlike gray opacity which occurred first at the region of the posterior pole and then into a doughnut shape, as described by Masuda and Cogan[15] on oblique illumination and around the shadow on transillumination.

Upon microscopic examination after enucleation, these opacities revealed slightly larger, different-sized granules, which were gathered rather thickly at the posterior pole, with thickened fibers arranged radially. These granules extended slowly over the whole surface of the posterior capsule (figs. 5 and 6).

Histopathologic findings at this stage showed Wedl's blistered cells or bladder cells, enriched with hyalogenically degenerated protoplasm which had very small atrophic nuclei. They appeared in the posterior cortex near the capsule and were arranged radially to the posterior pole region. There was a tuftlike or shell-like opacity clinically. These cells gradually increased in number, forming several layers

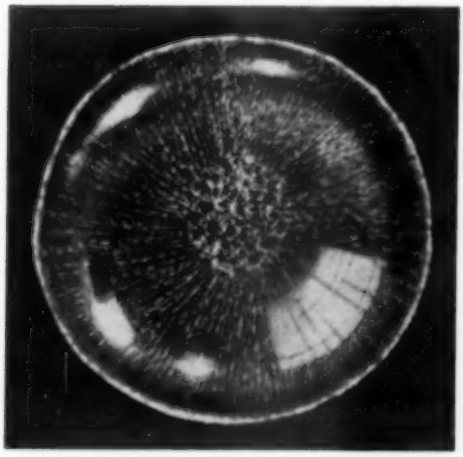

Fig. 6 (Kandori). The same lens as in Figure 5 examined microscopically after enucleation. Note the larger round opacities which consist of granules in the region of the posterior pole, with thickened lens fibers radiating from them.

Fig. 7 (Kandori). Histologically a tuftlike opacity from a lens irradiated with 350 r at 10 exposures shows, 163 days after the first exposure, bladder cells in the posterior cortex running radially to the pole under the capsule of which isolated epithelial cells are found.

at the posterior cortex of the lens in the form of doughnuts; they were bivalve-shaped opacities clinically.

The migrated epithelial cells under the capsule increased. They were arranged irregularly, forming an epithelial-like structure under the whole posterior capsule (pseudoepithelium). Some of the bladder cells resembled balloons; they were referred to as balloon cells by Cogan and Reese[15] (figs. 7 and 8).

Fourth stage. Advanced irradiation cataract stage. The opacity extended not only on a plane but also sagittally. After the gradual spread of these cells to the entire posterior cortex, the opacity appeared as a net or had a salt-and-pepper appearance; later, it appeared as a spindle-shaped milky opacity in the anterior cortex around the suture. The netlike opacities were composed of swollen lens fibers and the salt-and-pepper opacities of big bladder cells.

Histologically, there were bladder cells in the whole posterior cortex—some of them underwent fatty degeneration (fig. 9) while others were transformed into Morgan's globules (fig. 10). Fat substances were lost during fixation of the specimens. In the anterior cortex liquefaction of the lens

Fig. 8 (Kandori). Histologic examination of a lens irradiated with 1,500 r at single exposure, on the 309th day following irradiation, reveals doughnutlike or bivalvular opacities at the posterior cortex. Many bladder cells are arranged in several rows.

Fig. 9 (Kandori). Rabbit lens irradiated fractionally, 500 r, five times, 312 days after first exposure. Histologically it reveals many round or elliptical vacuolizations in the posterior cortex formed by fat degeneration of the bladder cells and loss of content during fixation. There are also many bladder cells between the vacuoles in the posterior cortex.

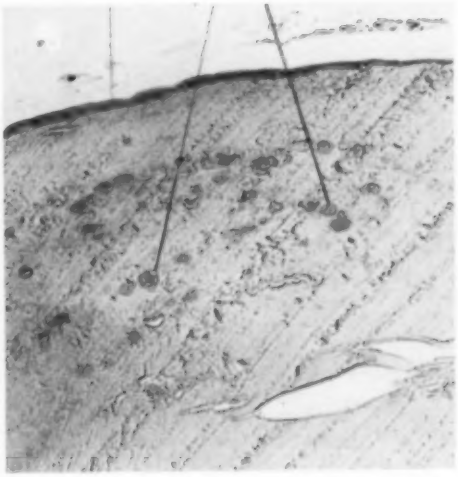

Fig. 10 (Kandori). Morgan's globules in the posterior cortex and pseudo-epithelial formation under the posterior capsule of a mature cataract (rabbit lens, 2,000 r, single exposure, enucleation 193rd day after irradiation).

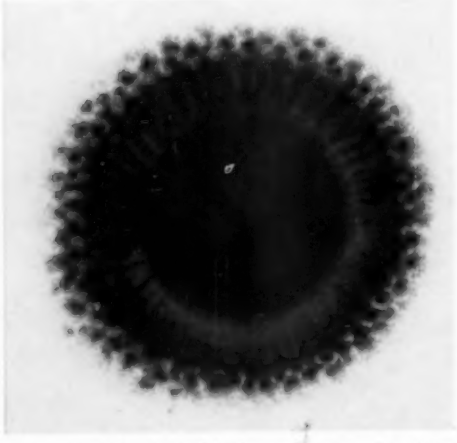

Fig. 11 (Kandori). Monkey eye exposed to 2,500 r, single exposure, six weeks previously. There is a pannuslike pigmentation of the cornea, followed by corneal opacity.

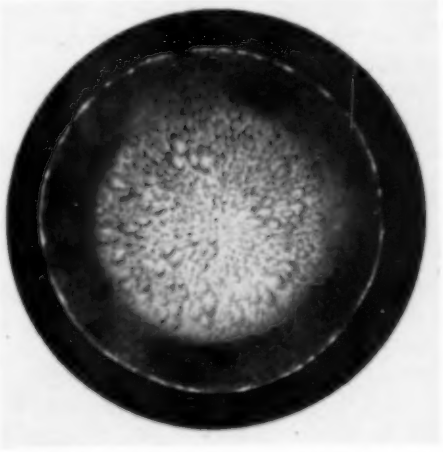

Fig. 12 (Kandori). Same as is shown in Figure 11, 210th day following irradiation. The matured cataractous lens is covered by corneal opacity. Note the foamy appearance at the posterior capsule which resembles the microscopic picture of the rabbit lens after enucleation.

fibers was noted, staining homogeneously with eosin. There was also pseudoepithelium forming under the whole posterior lens capsule. It was very interesting that, in radiation cataracts, changes occurred first in the posterior cortex, later in the anterior cortex.

Fifth stage. Matured cataract stage. The opacity extended to the whole anterior cortex and became a mature cataract. The lens became milky white with a water split at the anterior suture portion. Histologically there was destruction and liquefaction of all of the lens fibers (fig. 20).

b. *Clinical and histologic findings after large doses of irradiation.*

The clinical and pathologic changes already mentioned can be observed only after a conservative cataractogenic level of irradiation. If the dose is increased, many different pictures may be produced. With large doses of irradiation, the cornea and eyelids not only become inflamed but also may ulcerate. This experiment was carried out on monkeys' eyes.

A monkey's eye was irradiated with 2,500 r in a single exposure. It developed a lid inflammation after one week which became worse the following two weeks and healed in a month. There were pannuslike pigment infiltrations six weeks following exposure which caused keratitis after one month and later resulted in a corneal opacity. This concealed the lens cloudiness which developed into a mature cataract in 210 days (fig. 11). This lens revealed a foamy appearance at the posterior capsule similar to that in the rabbit (fig. 12).

The monkey which was irradiated with 1,500 r at a single exposure developed a colored-flash (golden-yellow reflex) stage after 150 days, changing into a posterior capsular opacity in 210 days. The histologic findings were similar to the third stage of the experimental data on rabbits eyes.

In the monkey irradiated with 1,100 r, a golden-yellow opacity was noted at the posterior pole region 260 days following the irradiation. The histologic findings showed that isolated epithelial cells had migrated under the posterior polar capsule.

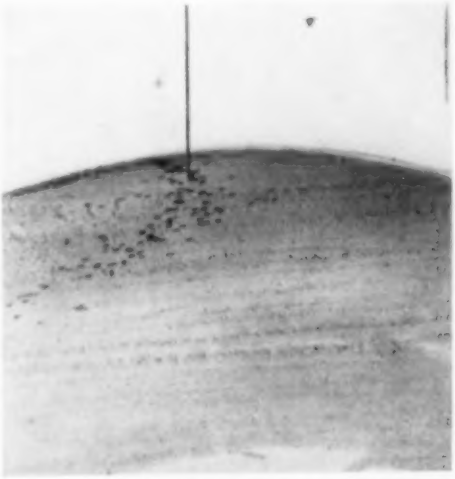

Fig. 13 (Kandori). Early changes in the equatorial region of a rabbit lens after irradiation of 900 r in single exposure, 262 days before enucleation. The bow of nuclei at the equator is slightly disarranged and there has been migration of the nucleus in the posterior cortex. Some lens epithelial cells are burrowing under the posterior capsule.

Judging from these results, the cataractogenic dose level of the monkey is almost the same as that of the rabbit.

Equatorial changes of radiation occurred in the rabbit with large-dose exposure. The bow of nuclei at the equator in the lens found with the small-dose exposure was disarranged and degenerated; the nuclei were decreased in number and had retreated to the posterior part of the lens cortex (fig. 13). As the exposure dose increased, these changes became more marked and more severe. With the largest dose of 2,000 r in a single exposure, the angle of the nuclear bow became so narrow that it lost its former figure completely and at last it was impossible to observe it (fig. 14).

The clinical findings of radiation cataract induced by large-dose irradiation, such as over 2,000 r in single exposure, were sometimes different from those of the cataractogenic dose level.

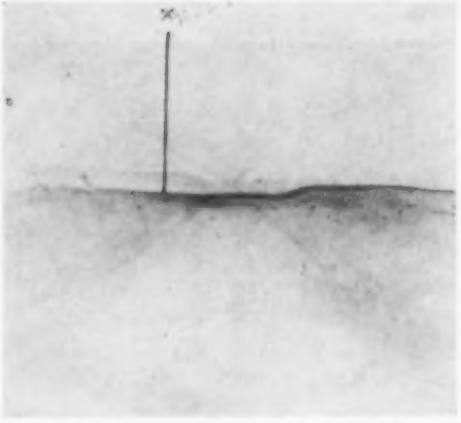

Fig. 14 (Kandori). Complete disappearance of the nuclear bow in the lens of a rabbit eye exposed to 2,000 r at single exposure 193 days previously.

a. In 104 days there appeared an irregular shaped, golden-yellow reflex which was larger than that formerly described. It could not be perceived by transillumination (fig. 15A).

b. On the 188th day, the golden-yellow reflex changed into a tuftlike opacity merging with the coronal-shaped cataract whose opacity was a needlelike thick one arranged radially (fig. 15B).

Fig. 15A (Kandori). Clinical symptoms in a rabbit eye irradiated with 2,000 r at single exposure. Note the irregularly shaped, golden-yellow reflex found at 104 days after irradiation. It could not be seen by transillumination.

Fig. 15B (Kandori). The same eye as shown in Figure 15A. Cataracta coronaria of the radiation cataract on the 188th day after irradiation. The lens showed a radial needlelike opacity at the periphery. A tuftlike opacity was also present in the region of the posterior pole.

c. Microscopically, this type of matured cataract revealed foamy granules spreading all over the posterior capsule. At the pole region all the granules were clouded in a grayish white substance (fig. 15C).

When the exposed animals were rats, the histologic findings of radiation cataract were markedly different, varying with the dose. With a small dose, such as 800 r, in single exposure, there were severe histologic changes. At the nuclear bow, nuclei were markedly decreased in number. Many nuclei were in the posterior cortex of the lens and many epithelial cells had migrated under the posterior capsule (fig. 16).

The lens which was irradiated 1,400 r in single exposure revealed bladder cells and a marked loss of cells at the nuclear bow of the equator (fig. 17). The changes became pronounced in the group irradiated with 1,600 r; the nuclear bow was completely destroyed and disappeared with liquefaction of the remaining lens fibers; very small

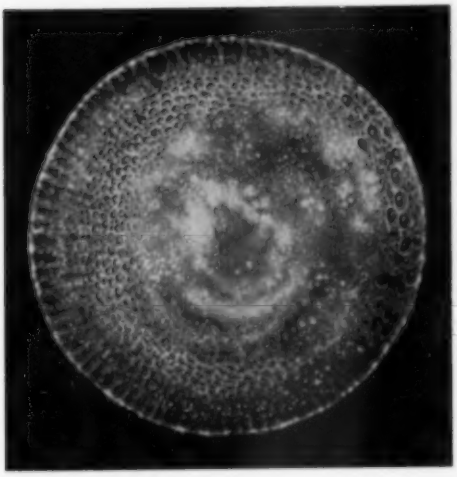

Fig. 15C (Kandori). The same eye as in Figures 15A and 15B, enucleated on the 193rd day and examined under the binocular microscope. Foamy granular elevations are arranged in the form of a rosary from the equator to the posterior pole where they are seen as a grayish white mist.

atrophic nuclei resembled bladder cells (fig. 18).

These histologic findings were noted in the early opacity of the equatorial lens in 40 days following large-dose irradiation. The microscopic findings of radiation cataract of rats were almost the same as those of rabbits. There was a foamy appearance all over the posterior capsule, whose size is smaller than in rabbits. The larger granules gathered at the posterior pole region and very small foamy, formed lines were arranged radially to the pole (fig. 19).

c. *Different reactions induced by the age of the experimental animals.*

1. Rats aged one or three months were irradiated with 1,200 r.

Clinically in the one-month-old rat, the irradiated field of the eyelids showed swelling in five days and marked epilation in 22 days. On the 50th day, there was a slight opacity under the anterior capsule in the periphery and a round opacity in the region of the posterior pole which increased in cloudiness to become a mature cataract on the 90th day; then there was a water-split

Fig. 16 (Kandori). Degeneration of the nuclear bow of a rat lens irradiated with 800 r at single exposure with enucleation on the 265th day. The lens showed a tuftlike opacity at the posterior pole. Histologically, the number of nuclei at the equator were markedly decreased and many had retreated to the posterior cortex of the lens. Many epithelial cells had migrated under the posterior capsule.

figure under the anterior capsule.

Clinically in the three-month-old-rat, there was a slight congestion but no swelling of the lid which had slight epilation at the 28th day following exposure. On the 150th day

Fig. 17 (Kandori). Mature cataract, rat lens, irradiated with 1,400 r at single exposure, after 170 days. Note the bladder cells at th eequatorial region with disappearanceof cells at the nuclear bow. In the rabbit eye, bladder cells do not appear in the equatorial region even with an irradiation dose as large as 2,000 r.

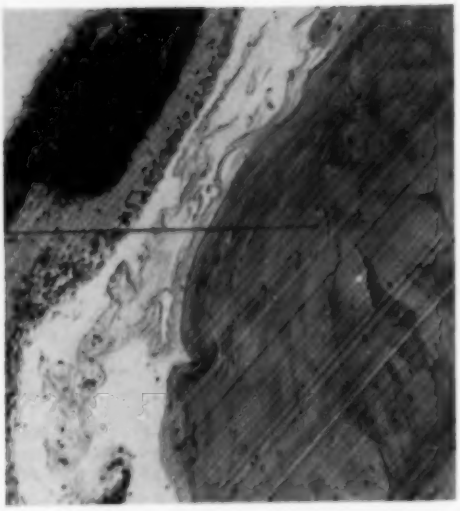

Fig. 18 (Kandori). Complete destruction of the nuclear bow at the equator of the matured cataract. Rat lens, 1,600 r, single exposure, after 150 days. The nuclear bow has disappeared completely, as may be seen from the epithelial cells of the lens capsule, and has changed into beginning lens fibers which resemble bladder cells.

there was a dotted opacity at the posterior pole which changed into a round tuftlike and markedly reflecting light opacity at the posterior capsule, with a radial opacity under the anterior capsule at the equator of the lens. The lens opacities increased as time went on and matured in 250 days.

Histologic findings of the one-month-old rat were: The epithelium cells, with atrophic nuclei which had vacuolized protoplasm, showed markedly irregular arrangement in some places extruding and in other places piling up in several layers. At the equatorial region, the cells appeared normal except for atrophic nuclei and vacuoles in the protoplasm. The nuclear bow disappeared completely. Situated in the inner layer of the cortex were many thickened lens fibers with small nuclei having big vacuoles in the protoplasm (fig. 20A). The posterior cortex of the lens was filled with Wedl's blister or bladder cells arranged like a stone wall. There were also pseudo-epithelium cell layers directly under the capsule (fig. 20B). The degenerating nucleus of the lens showed liquefaction, staining homogeneously with eosin.

Histologically, the three-month-old rat showed:

At the epithelium layer, atrophic nuclei were arranged irregularly but there was no vacuole in the cells. The cortex layer had degenerated into chromatin-rich nuclei which were scattered here and there. The structure of the nuclear bow had almost disappared and the nuclei were decreased in number; there was pseudo-epithial formation beneath the posterior capsule and bladder cells at the posterior pole.

d. *Histopathologic findings of the epithelium cells of the lens in radiation cataract after various doses of irradiation*

This experiment of rats' eyes employed only the flat specimens of the lens epithelium. The findings were markedly different according to the irradiation dose (figs. 21-24).

A rat irradiated with 800 r showed, after 307 days:

The lens epithelium had small pyknotic nuclei irregular in size and in disorderly

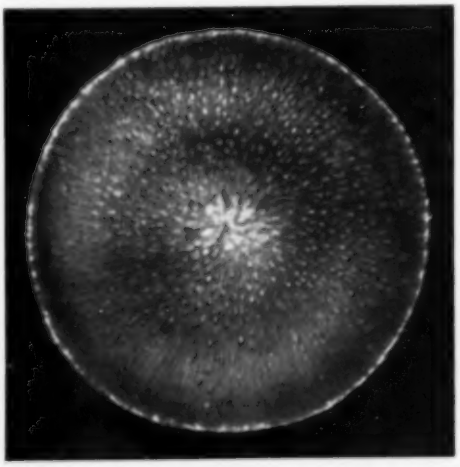

Fig. 19 (Kandori). Microscopic findings on the posterior surface of a rat lens irradiated with 1,000 r at single exposure, 225 days ago. Note the large, foamy structures in the region of the pole and the thin, foamy lines radiating from the pole.

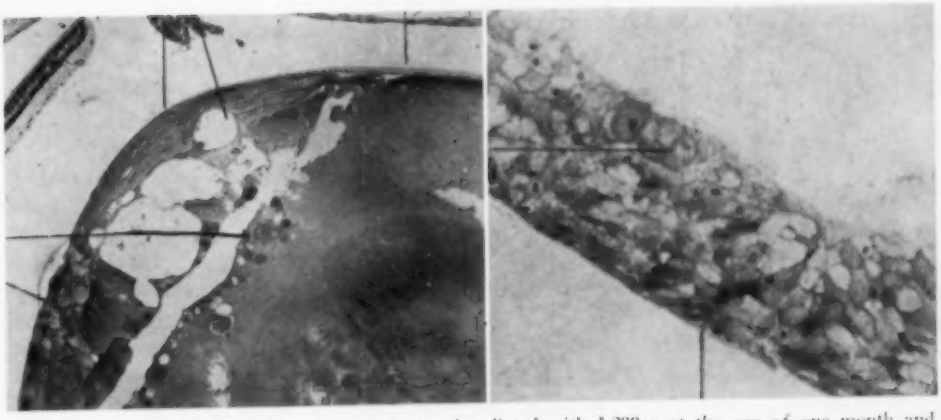

Fig. 20 (Kandori). Matured cataract, rat eye irradiated with 1,200 r at the age of one month and enucleated on the 165th day following the single exposure. (Left) Equatorial region of the lens. There are vacuoles in the cells of the capsule epithelium and marked destruction of the nuclear bow, with decrease of nuclei. The lens cortex is liquefied. (Right) Bladder cells arranged like stones in a wall in the posterior cortex of the same eye as shown at left. There are also pseudo-epithelial cells under the posterior capsule.

arrangement. Some of them had accessory nuclei. Normal arrangements of these cells could also be recognized (fig. 21).

Rats irradiated with 1,200 r and 1,400 r showed after 251 days:

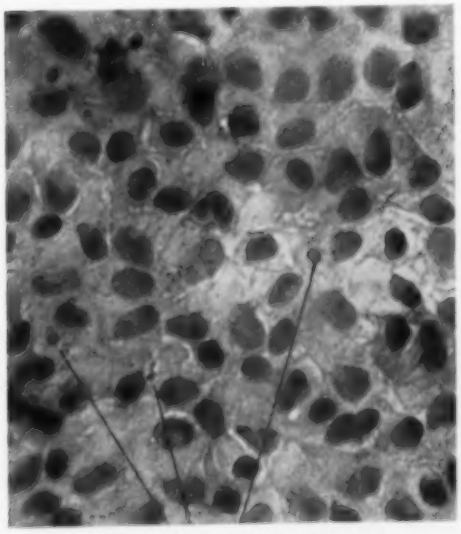

Fig. 21 (Kandori). Rat lens, 800 r, single exposure, 307 days prior to enucleation. Note the disarrangement of the epithelial cells whose nuclei have become irregular in size, with some having an accessory nucleus.

The epithelium cells of the lens were more atrophic and degenerated than those of 1,000 r rats. The cells were disarranged and their nuclei showed extrusion and some had vacuoles in the protoplasm (fig. 23). There were many places where the cells fell off.

A rat irradiated with 1,600 r showed after 150 days:

There was marked atrophy and degeneration of the epithelial cells with unequal nu-

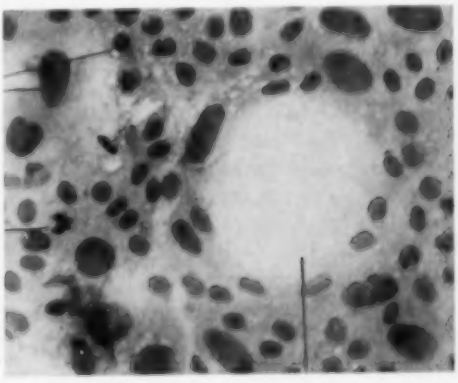

Fig. 22 (Kandori). Rat lens, 1,000 r, single exposure, 224 days prior to enucleation. Note how nuclear irregularity becomes more marked. Some of the nuclei show extrusion of the nucleus; in others there is dissolution with atypical mitosis.

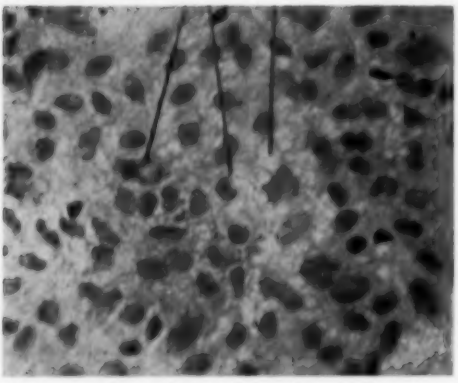

Fig. 23 (Kandori). Irregularity and extrusion of the nuclei and formation of vacuoles in the protoplasm of a lens, 251 days after irradiation with 1,200 r.

clei, some giant cells or dissolution of the nucleus (fig. 24).

In short, there were marked degeneration and atrophy of the epithelial cells in the radiation cataract which became worse as the dose of radiation increased.

3. Comments on radiation cataract

a. *Classification.*

The clinical course was divided into four stages by Milner:[7] First, formation of vacuoles; second, appearance of fine spots and feathery lines between and around the vacuoles; third, the formation of a central posterior plaque, roughly circular in outline, the rim of which is always slightly more dense in appearance than the remainder, the cloudy area becoming relatively clear with the plaque, spots, lines, and vacuoles extending forward and equatorially; fourth, the whole cataract.

Milner's division is quite similar to mine. His first stage corresponds to my first stage, that is, the thickening of the posterior capsule suture of the lens. His second stage corresponds to my colored-flash stage. His third stage has been divided into two parts in my classification. Duke-Elder[28] and Cogan and Reese[15] had only two stages in their classifications.

There was no reference to the classification of the histologic findings.

b. *Histologic findings in radiation cataract at different ages.*

There is no tissue of the eye which is more sensitive to irradiation than the lens of the fetal eye. Anomalies or unpredictable changes were demonstrated by von Hippel,[16] Politzer,[17] and von Szily.[18] There are also many descriptions of experimental radiation cataracts in young and rapidly growing animals (Tribondeau and Recamier,[20] Belley, Tribondeau and Belley,[19] Bossnet,[20] and Lorenz and Dunn.[21]) Duke-Elder[28] pointed out that the adult lens is less sensitive. However, the pathologic changes following irradiation are essentially the same in young and adult lenses.

It was easy to recognize a marked difference in the reaction of irradiation between the one-month-old rat and the three-month-old rat with the same dose, irradiated under similar conditions, and at the same period of observation. The one-month-old rat had many vacuoles in the epithelial cells of the lens and thickened lens fibers; bladder cells appeared at the equator in the lens cor-

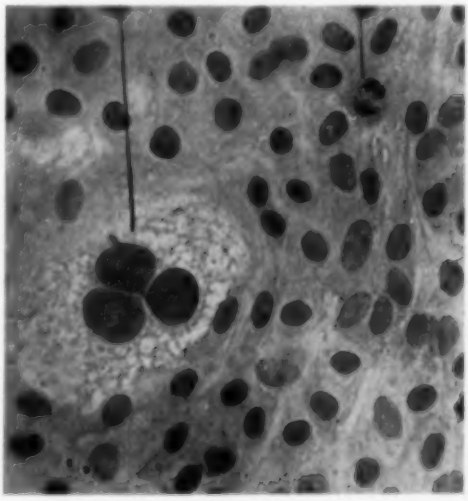

Fig. 24 (Kandori). Marked atrophy and degeneration of the cells, with unequal nuclei, some giant cells with huge nuclei, and mitotic figures of dissolution (1,600 r, single exposure, 150 days after irradiation).

tex; in a mature cataract, there were thick bladder cells at the posterior cortex. In the incipient cataract, bladder cells were missing and the other findings showed as tuftlike opacities. Atomic bomb cataracts probably demonstrate the same findings.

c. *The changes of lens epithelium examined by flat specimen.*

This study was at first carried out by Okuzawa,[13] in 1933, who examined the specimens one week to 22 weeks following X-ray irradiation with factors 120 kv., added 3 mm. Al, and 2.78 skin erythema dose. He demonstrated mitotic nuclear division with vacuoles in the cytoplasm; in four weeks such degenerative changes appeared in the nuclei as pyknosis, caryolysis, or vacuolization.

Poppe,[22] after 1,500 r, reported vacuolization in the nucleus after two days, accessory nuclei in six to nine days, defects created by giant cells and accessory nuclei filled by swelling of the neighboring cells after 10 days, pathologic mitosis with detached chromosome fragments in two months, nuclear polymorphism and giant cells in four months, and irregular arrangement of degenerated epithelium in 15 months.

Recently von Sallmann[23] reported early lens changes with 1,500 r irradiation. Thirty minutes after irradiation cell division had almost completely disappeared. This lasted three or four days and then recovery of mitosis took place in the next four days, followed by a one-to-two-week period of overcompensating increase in the proportion of dividing cells. Nuclear fragmentation and extrusion of material in the form of clumped chromatin globules began two hours after irradiation.

Almost all the studies of other research workers were carried out with the same dose of irradiation and the same length of follow-up. I used various doses of irradiation so that each specimen showed strikingly different findings—formation of accessory nuclei, sloughing off of the nucleus, atypical mitosis, irregularity of the nuclei, vacuolization in the cytoplasm, extrusion of nuclei, and giant cells with giant nuclei.

d. *Is radiation cataract progressive or not?*

There are some reports, Leinfelder and Kerr[9] and Duke-Elder,[28] which perceive the radiation cataract as nonprogressive. According to Duke-Elder the progress may stop at any stage and, if progression ceases at the vesicular stage, little visual impairment may ensue. In my experiments there were no nonprogressive cataracts; all were progressive. Even if they remained clinically stationary for a while, the anatomic changes became worse as time went on.

e. *What are the special findings of radiation cataract?*

According to Cogan, Donaldson, and Reese,[15] the clinical features of radiation cataract are: (1) the doughnut-shaped configuration, as seen with the ophthalmoscope, and (2) the sharply demarcated anterior boundary and bivalvular configuration of the opacity, as seen with the slitlamp biomicroscope. These are not seen in all stages of the radiation cataract but, when present, they are strongly suggestive of the radiation type and are usually sufficient to distinguish the radiation type from posterior polar cataract and cataracta complicata, with which it may easily be confused. In my experimental studies, a yellowish golden-colored flash was noted. It was similar to that seen in naphthalene cataract. There were, however, no tuftlike, doughnut-shaped, or bivalvular configurations. I cannot tell whether or not all cataracta complicata have such configurations.

The histologic changes of radiation cataract as noted by Cogan, Donaldson, and Reese[15] were failure of the cells at the equator to differentiate into lens fibers and early migration of cells beneath the posterior capsule toward the posterior pole. These are not the characteristic findings of the radiation cataract, since these findings are always regular changes in complicated cataracts. I have seen them in experimental naphthalene cataract.

Characteristic findings of radiation cataract include Wedl's blister, bladder or bal-

loonlike cells, even if this cell was found in cataract combined with retinitis pigmentosa or glaucoma. In other experimental cataracts, such as tetany or naphthalene cataracts, there are no bladder cells at the posterior cortex, even if there are isolated islands of epithelium cells and pseudo-epithelium under the posterior capsule.

With reference to Morgan's globules in radiation cataract, there was only one report on a fetal lens experiment by von Szily[18]—the cortex showed liquefaction. Some matured cataracts reveal Morgan's globules, which show an advanced stage of degeneration of the cells. This is not the characteristic finding in radiation cataract.

Pannuslike pigmentation of the cornea induced by irradiation was reported by Rohrschneider[4] only. Such an inflammation is very rare and it occurs only when the irradiated dose is too large.

Summary

The clinical course of radiation cataract may be divided into four stages: (1) Suture opacity; (2) golden-yellow flash; (3) dish, tuft or doughnut, and bivalvular opacity or net or pepper-and-salt opacity; (4) matured cataract.

Histologic findings with small doses were:

Migration of epithelium cells at the posterior suture and extending to the posterior pole region at the colored-flash stage, isolated epithelial cell islands, and, in advanced cases, pseudo-epithelial formation under the posterior capsule.

The dish, tuftlike, doughnut, or bivalvular opacity consisted of bladder cells which were arranged first radially to the posterior pole and then, as they increased, in many rows. These cells increased further changing into net or pepper-and-salt opacities consisting of many rows of bladder cells and enlarged lens fibers at the posterior cortex of the lens. Finally, the bladder cells degenerated further into fat or Morgan's globules. In the matured cataract the lens material became liquefied even at the anterior cortex.

The bow of nuclei in the lens was at first disarranged and degenerated; the nuclei decreased in number and retreated to the posterior cortex. As the disturbance grew, the angle of the nuclear bow became so narrow that at last it lost its former figure and could not be observed.

If large doses of irradiation were used, the findings were markedly different clinically and histologically:

Clinically, the differences appeared soon after the irradiation which at first caused an anterior cortex or equatorial opacity. If the dose of irradiation was large enough, corneal inflammation or ulcer or skin ulcer might occur.

Histologically, the nuclear bow disappeared completely; sometimes bladder cells or vacuolization could be observed at the equator of the lens.

There seems to be no species difference in the symptoms of radiation cataract but there is some difference in cataractogenic level which is influenced by species size and also by the age of the experimental animal.

Department of Ophthalmology,
Tottori University.

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N.F.12: A NEW TOPICAL SOLUTION FOR EXTERNAL EYE DISEASES*

CARLOS QUIROZ, M.D., AND TRUMAN BOYES, M.D.
New York
AND
ARTHUR SACKS-WILNER, M.D.
Trenton, New Jersey

N.F.12 is a new solution for use in external eye diseases. It consists of a combination of two antibiotics, neomycin, 0.12 percent, and gramicidin, 0.005 percent, supported by the antibacterial activity of Thimerosal, 0.002 percent, the antihistamine thonzylamine hydrochloride (Neohetramine), and the vasoconstrictor, phenylephrine hydrochloride, 0.125 percent, methyl and propyl paroben, pluronic F68, and propylene glycol. These ingredients are buffered to a pH 7.4 (pH of tears varies from 7.2, 7.35, 7.4, to 8.0, Duke-Elder) with sodium borate and boric acid, and thickened with methacel (4,000 centipoises).

Theoretically, the best solution to use is a buffered one, since the reaction remains stable. The antibiotics are stable in this solution, possess a wide spectrum of effective activity throughout a broad range of pH, and are particularly effective by topical use. Clinical use in other fields has shown that they do not lead to acquired sensitization or the induction of bacterial resistance after local application. Both antibiotics are bactericidal so that the chance for development of bacterial resistance is lessened.

In vitro tests with a concentration of 5.0 μg/ml. gramicidin inhibited strains of hemolytic streptococcus, pneumococci, and staphylococci. Neomycin is active particularly against a wide variety of gram-positive bacteria and many gram-negative organisms.

Neomycin is an antibiotic which is also stable, has a broad range of antibiotic activity, is effective over a wide range of pH, and is particularly effective in Pseudomonas aeruginosa and Proteus.

It is also noteworthy that the drug N.F.12 is effective in vitro against such notoriously refractory organisms as Pseudomonas aeruginosa—one which fails to respond to many antibiotics and other chemotherapeutic agents. To enhance the activity of the two antibiotics, Thimerosal, a potent bactericide, has been added.

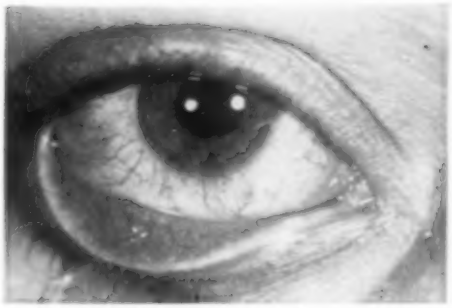
To decrease the discomfort of acute congestion and engorgement, the vasoconstrictor, phenylephrine, has been added to the solution together with Neohetramine, a well-established antihistamine.

This report describes the results of the

* From the Research Department of the New York Eye and Ear Infirmary. The Nepera Chemical Company, Inc., Yonkers, New York, kindly supplied the solutions used in this study.

KEY TO FIGURES 1–8 ⟹

Fig. No.	Patient	Symptoms	Laboratory	Diagnosis	Before Picture & N.F.12 Started	Results
1 and 2	D. K.	O.S. red	xxxx	Conjunctivitis, O.S.	2/15/55 5× daily	Figure 1 taken 2/16/55 Cured 2/18/55
3 and 4	E. S.	O.U. red purulent exudate	Staph. albus	Conjunctivitis, O.U.	3/23/55 6× daily	Figure 3 taken 3/30/55 Cured 3/30/55
5 and 6	S. H.	O.S. red purulent secretion & chemosis	Staph. albus Smear diphther.	Acute purul. conjunctivitis	5/16/55 7× daily	Figure 5 taken 5/18/55 Cured 5/24/55
7 and 8	I. R.	O.D. red Corneal infil.	xxxx	Keratoconjunctivitis	3/16/55 5× daily	Figure 7 taken 3/21/55 Cured 3/25/55



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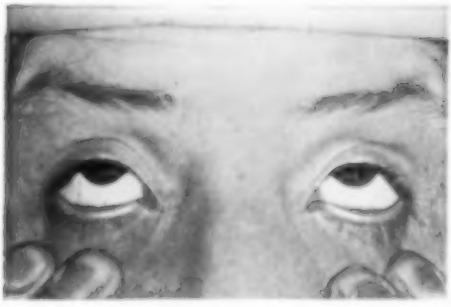

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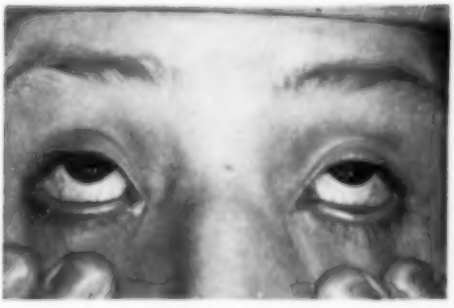

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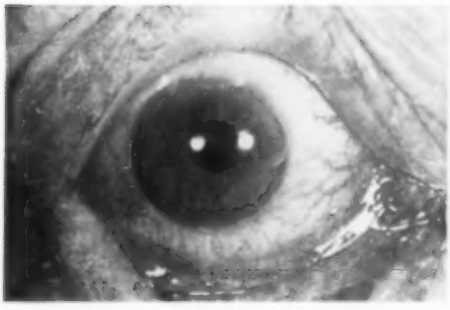

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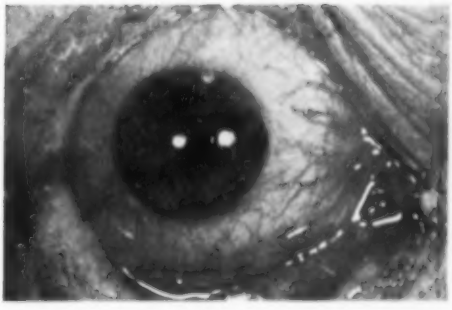

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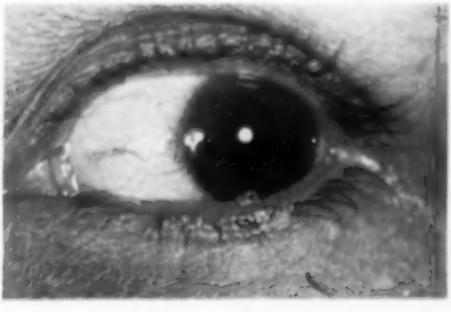

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After

Before

TABLE 1

RECORD OF FINDINGS

Case Number	Patient	First Seen	Symptoms	Diagnosis	Laboratory	Therapy	Results
1	E. W.	9/ 1/55	O.D., sore, burns, red 1+ edema, right upper lid, eye lashes stick together, 1+ conjunctival injection	Conjunctivitis O.D.	xxx	N.F.12 5× daily	Considerably improved, 9/15/55. Conjunctivitis, clear, no sticky eyelid, complains of burning at times
2	E. S.	3/23/55	O.U., red 2 days, pus in a.m. 2+ conjunctivitis, 1+ exudates purulent	Conjunctivitis O.U.	Staph. albus	N.F.12 6× daily, O.U.	3/30/55 complete recovery
3	M. R.	3/29/55	O.U., burning, for. body sensation, on and off, same history since 10/21/50, has received multiple Rxs such as sulfa, aureomycin, etc.	Conjunctivitis O.U., chronic	xxx	N.F.12 1× daily, O.U.	4/5/55 no complaints, completely cured at this time
4	D. K.	2/15/55	O.S., red, 2+ conjunctivitis, palpebral and ocular	Conjunctivitis O.S.	xxx	N.F.12 5× daily	2/18/55, cured
5	M. C.	2/ 9/55	O.S., irritated, 2 days, folliculitis	Conjunctivitis O.S.	Staph. aureus pathogenic; Staph. albus, nonpathogenic	N.F.12 5× daily	2/11/55 much improved
6	J. T.	2/ 4/55	Discharge, O.U., O.S. + O.D., lids red, puffy. O.U., red. Prosthesis, O.S. Canaliculus obstructed O.D., since 1952. Numerous Rxs	Blepharoconjunctivitis, O.U.	xxx	N.F.12 5× daily	4/11/55 no complaints, states eyes feel better than at any time
7	S. G.	1/28/55	Burning, O.D.+O.S. conjunctivitis, injected 2+, fibrinous exudate lower fornices, O.U.	Conjunctivitis O.U.	O.D., Alcaligenes fecalis. O.S., Strep. mitis; staph. albus	N.F.12 5× daily	2/2/55 improved. Very slight improvement since 2/2/55
8	I. D.	3/ 8/55	O.U. burning and pain O.D./O.S. 3 days, 1+ conjunctivitis, corneal infiltrate	Conjunctivitis O.U.	xxx	N.F.12 5× daily	3/10/55, pain, corneal infiltrate O.D., as previously noted with vascular engorgement adjacent, lid margin chronically inflamed and skin excoriated
9	S. C.	11/19/54	O.D., red, tearing, conjunctivitis, injected	Conjunctivitis O.D.	Staph. albus. Strep. mitis	N.F.12 3 hr.; then 4× daily	11/26/54 cured
10	J. P.	12/11/54	O.U., red, irritated, and tearing	Conjunctivitis O.U.	O.S., Staph. albus; O.D. gram-negative bacteria unidentified	N.F.12 4× daily	12/21/54 cured
11	B. K.	12/14/54	Tearing, reduces vision O.D. 10 days, follicular conjunctivitis, O.D./O.S.	Conjunctivitis	O.D., Proteus vulgaris O.S., negative	N.F.12 6× daily	12/21/54 cured
12	P. H.	12/11/54	O.U. red 2 days, pus in a.m. O.U. 1+ exudate, O.U.	Conjunctivitis O.U.	O.D., no growth O.S., Staph. albus; nonhemolytic Strept.	N.F.12 5× O.U. daily	12/16/54 improved 12/20 cured
13	E. S.	11/27/54	O.U. lids red, 5–6 days various antibiotics and cortisone were unsuccessful. Eyes remained red and lids scaly	Blepharoconjunctivitis	11/28/54 pathogenic Staph. O.U. 12/8/54, cultures O.D. pathogenic Staph. aureus; O.S., pathogenic Staph. albus	N.F.12 6× daily. Scalp therapy	12/16 much improved 12/23 remarkable improvement 12/27 culture no growth 12/14 marked improvement
14	I. R.	3/16/55	O.D., red 3 days, corneal infiltrate	Keratoconjunctivitis	xxx	N.F.12 5× daily	3/25/55 cured
15	E. M.	3/15/55	O.D., red, painful 2 days, conjunctivitis 2+, exudate 1+	Conjunctivitis	xxx	N.F.12 5× daily, hot compress	3/19/55 not improved. Chemosis, penicillin administered. No follow-up
16	R. D.	2/11/55	O.D., red, painful, 2 days, 2+ conjunctival injection	Conjunctivitis	xxx	N.F.12 5× daily	2/18/55 cured
17	M. T.	2/19/55	O.U., red 4 days, some pain, marginal Zeiss vesicle	Conjunctivitis corneal stain	O.D., Staph. O.S., Strep. mitis	N.F.12 6×, 300,000 units penicillin	2/26/55 cured
18	D. W.	2/24/55	O.D., buring, red, 2+ conjunctivitis	Conjunctivitis	Staph. albus	N.F.12 6× daily	2/26/55 marked improvement

TABLE 1—(*continued*)

Case Number	Patient	First Seen	Symptoms	Diagnoses	Laboratory	Therapy	Results
19	J. K.	3/ 2/55	O.U., red periodically for past few months	Episcleritis O.U.	xxx	N.F.12 5× daily	3/9/55 marked improvement
20	F. S.	3/18/55	O.D., red, pus profuse, 3+ purulent secretion, subconjunctival hemorrhage	Conjunctivitis severe, anterior auricular adenitis	xxx	N.F.12 every 4 hr., penicillin 300,000 units	3/26/55 cured
21	J. B.	3/22/55	O.D., painful, red, corneal stain, ciliary and conjunctival injection severe	keratoconjunctivitis	Staph. albus, nonpathogenic	N.F.12 and patch 3/23; N.F.-12 every 3 hr.	3/26/55 cured
22	R. B.	3/23/55	O.D., red, painful, 1+ lid edema, chemosis, conjunctivitis	Blepharoconjunctivitis	Staph. albus	N.F.12 6× daily	3/30/55 cured
23	M. S.	3/ 5/55	O.D., burning, red 3 days; secretion in a.m., purulent	Conjunctivitis moderately severe	No culture	N.F.12 6× daily	3/9/55 cured
24	T. K.	3/ 9/55	O.S., red 5 days sensation of foreign body	Marginal infiltrate with conjunctivitis	No culture	N.F.12 5× daily	3/11/55 much improved
25	E. Z.	3/25/55	O.U., red; O.S./O.D., purulent exudate; O.S., conjunctivitis severe	Conjunctivitis O.U., severe	No culture record	N.F.12 6× daily	3/25/55 much improved no exudate. 3/27 cured
26	S. R.	3/29/55	O.U., scaly lids, conjunctivitis, red, irritated, scalp seborrhea	O.U., blepharoconjunctivitis	xxx	N.F.12 5× daily, scalp therapy	4/2/55 much improved
27	E. D.	3/29/55	For. body sensation left upper lid, 1+ edema left upper lid, 1+ follicular conjunctivitis, had cyst removed a year ago	O.S., follicular conjunctivitis	xxx	N.F.12 5× daily, hot compress	4/6/55 much improved, no complaints
28	M. E.	3/24/55	Purulent discharge, O.U., four days; lids swollen, O.U.	Conjunctivitis purulent	Culture, O.S., M. tetragenes	N.F.12 4× daily, O.U.	5/29 cured
29	J. T.	2/ 4/55	Discharge, O.U., with blepharitis	Blepharoconjunctivitis	O.S./O.D., coagulase and manitol negative, nonhemolytic Staph. albus O.D.	N.F.12 5× daily	3/25/55 no complaints, no discharge, O.U.
30	S. H.	5/16/55	O.S., red, purulent secretion, chemosis, 5 days' duration	Acute purulent conjunctivitis O.S.	O.S., pathogenic nonhemolytic Staph. albus, smear diptheroids, epithelioid cells rare with inclusion bodies	N.F.12 7× daily	5/24 cured
31	E. T.	5/18/55	O.D., red, seromucoid discharge 3 days	Conjunctivitis, O.D.	Culture, O.D., coagulase manitol negative, nonhemolytic Staph. albus	N.F.12 every two hr.	5/23 much improved, no complaints
32	W. H.	6/ 6/55	O.S., red, burning 3 days, mucopus	Conjunctivitis, O.S.	xxx	N.F.12 5× daily	6/14 cured
33	V. M.	5/ 9/55	O.D., red, painful, chemosis of the lids	Conjunctivitis, O.D.	Cultures negative, probably virus infection	N.F.12 5× daily	5/16 cured
34	J. C.	5/ 9/55	Postoperative muscle surgery	Postoperative muscle surgery	Coagulase manitol negative, nonhemolytic Staph. albus, occasional erythrocytes	N.F.12 4× daily	6/3/55 no complaints, conjunctiva has returned to normal, cured
35	J. M.	5/11/55	O.S., red on and off one month, purulent exudate	Conjunctivitis	Staph. albus	N.F.12 5× daily	5/20 cured
36	T. G.	5/ 7/55	Keratoconus; O.U., red; O.D., numerous nebulae	Keratoconjunctivitis (corneal abrasions—contact lens, trauma)	xxx	N.F.12 5× daily	5/19 cured
37	M. D.	5/12/55	Lids red, numerous vesicles, O.S., over lid and forehead, lid edema, painful, for. body sensation	Herpes zoster ophthalmicus	Culture M. tetragenes, smear rare gram-positive bacilli and cocci, many epithelioid cells	N.F.12 every 2 hr.	6/17/55 cured, ophthalmological findings normal

TABLE 2

ADDITIONAL CASES WERE LISTED CLINICALLY AS CURED, IMPROVED, OR NO IMPROVEMENT

Patient	Diagnosis	Therapy	Result
A.P.	Conjunctivitis, allergic to atropine	N.F.12 every 2 hrs. 5/23/55	6/2/55 cured
M.P.	Conjunctivitis	N.F.12 4×daily 5/23/55	5/30/55 cured
T. S.	Subconjunctivitis, hemorrhage and conjunctivitis virus?	N.F.12 every 3 hrs. 5/23/55	6/6/55 cured
J. B.	Limbar ulcer, episcleral injection	N.F.12 4×daily 5/23/55	6/6/55 cured
D. T.	Postoperative strabismus	N.F.12 4×daily 5/23/55	6/1/55 improved
P. G.	Conjunctivitis (allergic)	N.F.12 every 2 hrs. 5/23/55	Immediate relief from itching, 6/6/55 cured
J. K.	Conjunctivitis secondary to seborrhea of the scalp	N.F.12 4×daily, 5/26/55	5/31/55 marked improvement
W. H.	Conjunctivitis, severe edema (virus)	N.F.12 every 2 hrs. 5/26/55	5/2/55 marked improvement 6/8/55 cured
E. O.	Dendritic keratitis severe	N.F.12 every 2 hrs. 5/28/55, aureomycin	6/18/55 marked improvement with relief of pain continuing
J. B.	Conjunctivitis, edema, subconjunctival, hemorrhage severe (virus?)	6/14/55 N.F.12 every 2 hr.	6/18/55 improving rapidly and ss subsiding
S. N.	Conjunctivitis (virus), rhinopharyngitis	6/15/55 N.F.12 every 3 hr.	6/20/55 improving 6/23/55 cured
R. R.	Conjunctivitis, edema severe (virus)	6/18/55 N.F.12 every 2 hr., Sulamyd 10% 4×daily	6/23/55 condition subsiding rapidly

topical use of N.F.12 in 45 unselected cases. Each case was evaluated clinically, a culture was made in most cases, and before and after color photographs were made in a number of cases. The only complaint in some patients was a mild stinging sensation on instillation, which was only transitory and persisted only for a few moments. No other side effects were noted. Table 1 is a record of the findings. Table 2 lists those cases which were treated after completion of the first series.

RESULTS

Of 37 cases of conjunctivitis, with cultures and smears, all but two were entirely cured and symptom free. One of the two showed no improvement after two days' treatment and the other did not improve after three days' therapy. No follow-up was available, although medication was continued. Six cases of keratoconjunctivitis were all cured or improved after therapy was instituted. Two cases of episcleritis were cured. One patient with herpes zoster was cured ophthalmologically. Improvement in a postoperative muscle case was noted.

Among the additional 12 cases (table 2), it was noted that there were two caused by allergic phenomena, one dendritic keratitis, and one ocular infection associated with rhinopharyngitis. All of these were benefited by the drug.

SUMMARY

A new topical solution has been described. The only side effect noted in this series was a stinging sensation on instillation in some of the patients. Symptoms of acute congestion were relieved in a short time. Relief was also noted in the allergic type of conjunctivitis.

The medication is safe and because of its wide spectrum can be used in most external ocular infections, allergies, and postoperative reactions. It can be used in combination with mydriatics, sulfa drugs, aureomycin, and so forth.

654 Madison Avenue (21).

225 West State Street.

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BIOCHEMICAL STUDIES ON VITREOUS STABILITY*

Robert Brunish, Ph.D.

Los Angeles, California

Since the vitreous humor is 99.7 percent water and contains approximately 0.1 percent colloid material, it is difficult to explain its stability, turgidity, and impermeability. The two distinctive components of the vitreous are the residual protein and hyaluronic acid. In 1935, Friedenwald and Stiehler described the residual structure remaining after the soluble components had been leeched away.[1] This resulting framework, while occupying the same dimensions as the original vitreous sample, no longer had the ability to hold its shape or retain its fluid content when it was not supported by a surrounding aqueous solution. This proteinaceous structure, within a certain limited amount of elasticity, appears to maintain the volume of the vitreous.

Shrinkage temperature studies

The question has been raised by many workers in this field concerning the possible role of hyaluronic acid in maintaining the integrity of this protein system. No firm chemical bonding has been demonstrated and, indeed, the ease with which the polysaccharide is removed from the residual protein argues against such bonding. Nonetheless, Pirie and others have postulated a reciprocal protective action of these components which may be, in part at least, physical as well as chemical.[2]

Jackson has recently studied the interaction of collagen and chondroitin sulfate in tendon.[3] Chondroitin sulfate and collagen in this tissue constitute a system similar in many respects to that of the hyaluronic acid and residual protein found in the vitreous humor. Jackson found that the stability of tendon as measured by the shrinkage temperature of isolated collagen fibers was dependent upon the mucopolysaccharide. When chondroitin sulfate was removed chemically or enzymatically the collagen fibers were less stable than they had been in the presence of the mucopolysaccharide. The addition of chondroitin sulfate to treated collagen fibers restored the original stability.

To determine whether the stability of the residual protein from vitreous humor is correspondingly dependent upon the presence of hyaluronic acid, shrinkage temperature experiments were undertaken.

Methods

Vitreous humor residual protein was obtained from beef eyes by the following procedure:

* From the Department of Physiological Chemistry, School of Medicine, University of California Medical Center. Supported by a grant from the Estelle Doheny Eye Foundation.

Eyes were obtained from freshly slaughtered cattle. These eyes were immediately placed in a mixture of dry ice and acetone and quickly frozen. This process allowed large numbers of eyes to be obtained and stored without decomposition. The frozen eyes were placed in warm water so that the outer tissues would thaw quickly while the vitreous mass remained frozen. It was then possible to remove frozen vitreous samples freed from surrounding tissue. The frozen samples were crushed and the resulting suspension was thawed and centrifuged at 3,000 r.p.m. for 30 minutes at 0°C. The residual protein, which was centrifuged down, was suspended in physiologic saline and recentrifuged two times. The fibers were then suspended in 5N sodium chloride and dialyzed against 5N salt overnight in the cold. This procedure was undertaken to reduce any potential salt bonds between hyaluronic acid and the protein. The fibers were again centrifuged, resuspended in distilled water, recentrifuged and resuspended a second time in distilled water. This suspension was dialyzed against 200 volumes of distilled water and following this the fibers were centrifuged and dried by lyophilization.

A second procedure was utilized to prepare residual protein. This procedure was the leeching out of the soluble components as described by Friedenwald and Stiehler.[1]

The technique of shrinkage temperature measurements employed was essentially that of Jackson.[3] A portion of vitreous residual protein fibers was placed in a small test tube with the aqueous medium to be investigated. The fibers were allowed to equilibrate with the medium for one hour. Following this time interval, the contents of the tubes were slowly heated while the fiber mass was observed under magnification.

As the temperature rose a point was reached at which the fiber mass suddenly contracted. This point is the shrinkage temperature of the fiber and it represents the point where the disruptive thermal forces

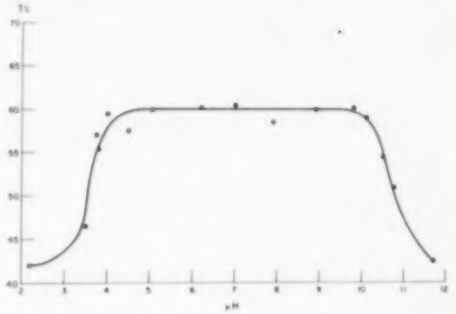

Fig. 1 (Brunish). Residual protein in 0.14 M NaCl.

overcome the intermolecular bonds to the extent that the intramolecular forces can cause the molecules to fold and the fibers to contract. This phenomenon is explained then on the basis of each fiber being composed of elongated molecules which are held together in an oriented fashion by electrostatic and hydrogen bond forces.

As the disrupted thermal energy breaks the bonds between adjacent molecules, the individual molecules are free to fold or contract and to form a new stable state by internal bonding. Because the intermolecular forces are the cohesive bonds of the fiber, the heat which must be applied to cause contraction is a measure of the stability of the fibrous system. Since the higher the temperature the more stable the fiber, anything in its medium which lowers its shrinkage temperature has adversely affected its stability. This technique, therefore, allows us to study the residual protein of the vitreous humor and to determine what factors may influence its stability.

Results

Figure 1 represents a plot of shrinkage temperature against pH for fibers suspended in physiologic saline adjusted to the proper pH. The values recorded in this table and elsewhere are average values, with standard deviations of ± 1.0 degree. As can be noted there was no reduction of shrinkage temperature (or stability) over a wide pH. Approaching a pH of either 3.9 or 9.5 the

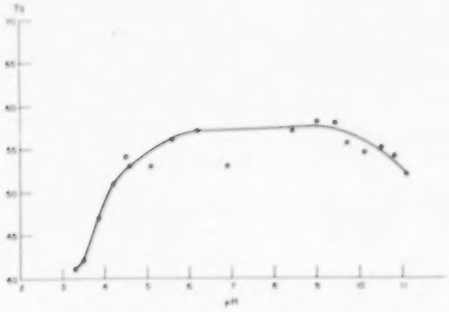

Fig. 2 (Brunish). Rabbit vitreous humor in 0.14 M NaCl.

shrinkage temperature decreased markedly. Since this is the region where the ε-amino groups of lysine, on the one hand, and the second carboxyl groups of aspartic and glutamic acids, on the other hand, are being protonated, the reduction at these extremes of pH may have reflected the contribution of salt linkages through these groups. Fibers prepared by the two techniques described above gave identical results.

To determine whether the vitreous humor would display a shrinkage phenomenon similar to that of the isolated fibrous component, unfrozen rabbit vitreous humor was dissected from surrounding tissues with the exception of the lens. It was necessary to leave the lens attached to the vitreous in order to maintain the integrity of the vitreous membrane. The tissue, so prepared, was placed in physiologic saline for the determination of shrinkage temperature. The small differences in refractive index between the vitreous humor and the saline solution made these measurements more difficult than with the isolated fiber.

The data obtained are seen in Figure 2. This graph is similar to that obtained with the isolated fiber, with the difference that it is somewhat lower and that it starts to drop at a higher pH as acid is added. These differences could be due to one of two factors, or to both: first, they might be ascribed to a different fibrous system, that is, the isolated fibers differ from those of the intact vitreous humor; alternatively, the difference could be due to a changed environment surrounding the fiber.

In the first figure the fiber was bathed by physiologic saline, while in the second case the fiber was surrounded by vitreous fluid which was in turn bathed by physiologic saline. To determine which of these two factors accounts for the difference, the residual protein was suspended in a vitreous filtrate rather than in physiologic saline. Vitreous filtrate is the viscous fluid component of the vitreous humor obtained by the removal of the residual protein, either by filtration or centrifugation.

Figure 3, which represents the data obtained by suspending residual protein in vitreous filtrate adjusted to the desired pH, shows a striking similarity to the data obtained from the intact vitreous humor samples. This would strongly support the concept that the isolated fibers have a counterpart in the intact vitreous and are not derived artefacts.

The factor or factors present in the vitreous humor which lower the shrinkage temperature curve of the fibers have not yet been identified. To determine if these factors were low molecular-weight compounds, dialysis experiments were undertaken. A portion of the vitreous filtrate, used as the medium for the shrinkage temperature determination, was dialyzed against physio-

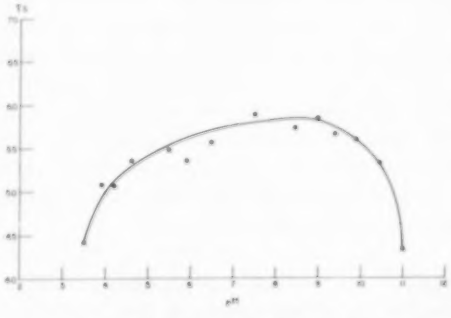

Fig. 3 (Brunish). Residual protein in vitreous filtrate.

logic saline. Dialysis was performed in the cold, for 24 hours, utilizing five-eighths inch diameter Visking casing. This prior treatment of the vitreous filtrate gave rise to values intermediate between undialyzed vitreous filtrate and physiologic saline (fig. 4).

Since the inherent difficulties of dialyzing such viscous solutions may have prevented complete dialysis, the effects noted appear to reflect the presence of specific inorganic ions, rather than protein or other macromolecules. Marked effects on the shrinkage temperature of rat tail tendon have been induced by varying the concentration of the common cations.[4]

To determine the possible effect of hyaluronic acid upon the stability of residual protein, the shrinkage temperature of the fibers was determined in physiologic saline, and in physiologic saline containing 0.1-percent hyaluronic acid. No change was seen. Chemical analysis of the residual protein had given values of 0 to 0.2-percent hexosamine. To exclude any possibility that the trace of hexosamine associated with the fiber might represent hyaluronic acid or some other polysaccharide acting as a stabilizing agent the fibers were subjected to the action of hyaluronidase and the shrinkage temperatures measured upon transferring the samples to saline again. No change was noted in this series of experiments. It therefore appears that the fibrous network is not dependent upon hyaluronic acid for stability.

Discussion

Cohen[5] and Partridge[6] have discussed the orientation of protein under the influence of mucopolysaccharides. Cohen has demonstrated that many high molecular weight proteins will precipitate in the form of long micelles in the presence of heparin, chondroitin sulfate, or hyaluronic acid. The precipitates formed, however, do not contain appreciable amounts of polysaccharides and occur at physiologic pHs where salt com-

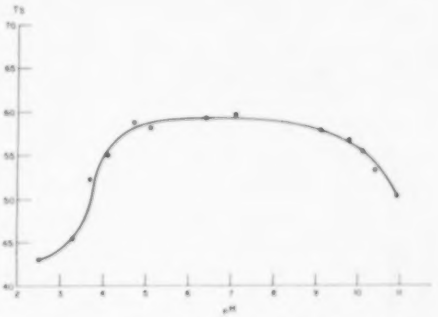

Fig. 4 (Brunish). Residual protein in dialyzed vitreous filtrate.

plex formation would not be expected. Also hyaluronic acid is more effective in producing these long micelles than chondroitin sulfate. Depolymerization of hyaluronic acid prevents this action. Partridge has suggested that collagen fibers developing in connective tissue may be organized by the chondroitin sulfate. A similar reaction may be involved in the vitreous humor. Once the fiber is formed it no longer may be dependent upon the polysaccharide. The present study does not support or contradict this theory.

It is noted that the temperature at which shrinkage of the isolated fibers occurs is produced, apparently, during diathermy treatment of retinal detachment. Undoubtedly protein changes occur in a localized area. It is difficult to assess the ultimate effect of this process because of the capacity of living tissues to repair its damaged parts.

Water-uptake studies

The low content of colloid in the vitreous humor makes it difficult to explain its apparent gel state or its ability to hold water. That this ability to hold water is a complex affair is evidenced by the following observation:

If a beef vitreous sample is carefully dissected from the surrounding tissue, it maintains its integrity. If a light equatorial cut is made, the vitreous tends to flow through the cut surface. The amount which flows is limited, however. It is not comparable to

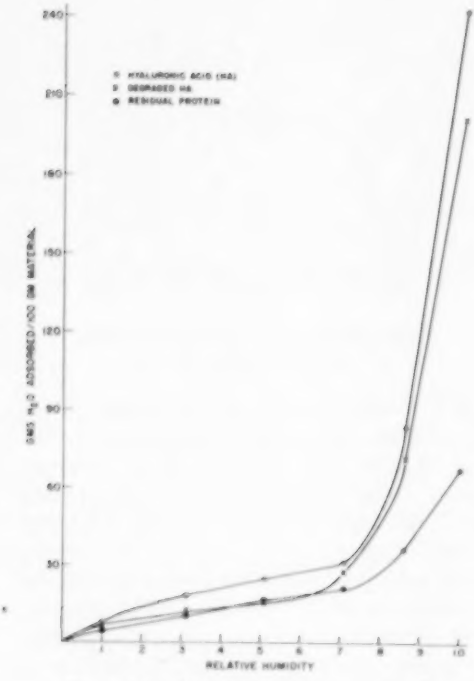

Fig. 5 (Brunish). Uptake of water versus relative humidity.

the fluid lost upon nicking a balloon filled with water. If a deeper cut is made in the same area, an additional amount of fluid loss will ensue.

The suggestion has been made by Friedenwald and Stiehler[4] that the vitreous is made up of concentric sheets of protein separated by an extremely viscous fluid. In other words, the gel qualities of the vitreous are due not to a gel comparable to gelation or jelly, but due to a physical entrapment of a viscous fluid in a protein network. Judging from parallel situations in other tissues, however, mucopolysaccharides are important in maintaining water balance.[7] It does not appear likely, then, that the water retention is due solely to a physical entrapment of fluid by a protein barrier which should be water penetrable.

In order to discover other possible factors the degree of water interaction with the protein and hyaluronic acid of the vitreous was studied.

Methods

Water-uptake studies were carried out on the isolated chemical components with the assumption being made that the isolation techniques themselves did not alter these components. The water-uptake studies were performed on hyaluronic acid, hyaluronic acid depolymerized by hyaluronidase, and upon the residual protein. These experiments were carried out as follows:

The sample to be studied was carefully weighed. It was placed in a closed system maintained at 25°C. and a constant relative humidity. The humidity was controlled through the use of saturated salt solutions.[8] After the system had reached equilibrium, the sample was reweighed to determine the amount of water it had taken up. A plot of uptake of water versus relative humidity has been made and this is seen in Figure 5.

Results

The curves obtained are similar to those seen with many proteins.[8, 9] The water uptake at the low relative humidities represents Van Der Waals' adsorption while the relatively large increase in absorption above 0.7 relative humidity is due to multilayer absorption of water. It might be noted that the depolymerized hyaluronic acid appears to absorb less water on a weight basis than the native hyaluronic acid. The curve for the residual protein falls even lower. Whereas, the amount of water bound by solid material in the presence of water vapor cannot be directly compared to the amount of water which the material would bind if it were present in solution, it would be anticipated that the relative bonding capabilities of hyaluronic acid and depolymerized hyaluronic acid would be similar in the two systems. It would appear reasonable, then, that depolymerization of hyaluronic acid, without any net change in content, would result in the presence of lower water bonding.

Discussion

The ability of the vitreous humor to hold water may reside primarily in its hyaluronic acid moiety. This appeared to be true of the mucopolysaccharide components of other tissues including the cornea[10] and orbital fat.[11] Presumably, the volume of the vitreous humor is limited. Increased hyaluronic-acid content or depolymerization of hyaluronic acid without change of content might be expected to change the amount of water which this material binds. Admittedly the normal concentration of hyaluronic acid is low, and it is not known whether the magnitude of these changes could be large enough to be of importance clinically. It is felt, nevertheless, that the hyaluronic acid-hyaluronidase balance plays a part in maintaining the normal turgidity of the vitreous. This enzyme substrate system may also play a role, although on a less significant level, in regulating the intraocular pressure.

Summary

1. The stability of the residual protein fiber system was studied through shrinkage temperature measurements.

2. The integrity of the residual protein fibers was not found to be dependent upon hyaluronic acid, as evidenced by the shrinkage temperature experiments.

3. Hyaluronic acid, when deploymerized, binds less water than when in the native state, as shown by the water-uptake studies.

4. It was suggested that the hyaluronic acid-hyaluronidase balance may regulate the turgidity of the vitreous humor and may play a smaller part in determining intraocular pressure.

University of California
Medical Center (24).

Acknowledgment

I am indebted to Dr. S. Rodman Irvine for his interest and helpful suggestions.

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READING EFFICIENCY OF 809 AVERAGE SCHOOL CHILDREN*

The effect of reversal on their performance

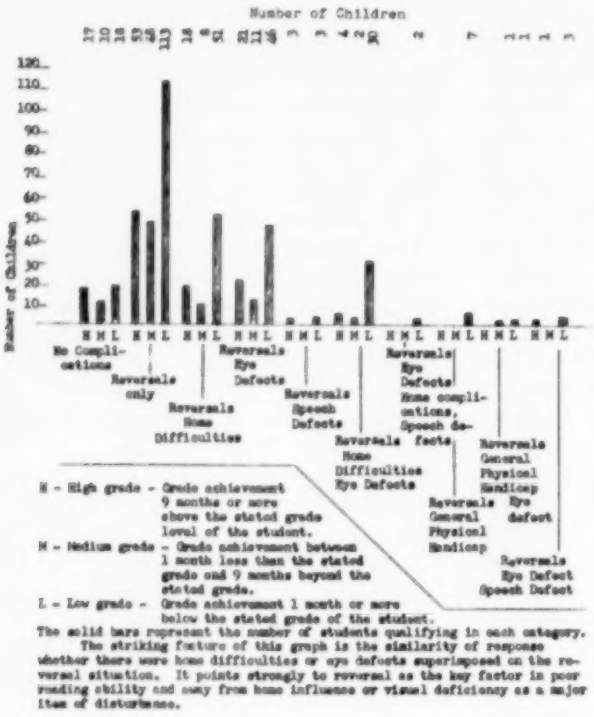
Edwin M. Shepherd, M.D.
Charleston, West Virginia

Preface

The term reverser and reversal as applied to school children may be obscure to some. Our interpretation is that a reversing reader either manifestly reads words backward, as in calling "was" "saw," or tends to attempt this to such a degree that his reading speed and comprehension are faulty. Dr. Orton used the term "strephosymbolia" to convey the same idea.[17]

Reversing as a primary psychologic effect is not universally accepted. Many able investigators believe that it is an expression of an anxiety situation, an infantile reversion.

* From the Department of Ophthalmology, Jefferson Medical College, Philadelphia, Pennsylvania.



Graph 1 (Shepherd). Reading ability (Gray Oral test of grade level). Superior intellect group, 473 of 809 tested.

The purpose of this paper is to show reversing as a widely manifest psychologic fault, not a matter of presence or absence so much as of degree.

Rychener[19] advocated a simple word list as a screening method for finding children in whom this fault was a real defect. We have found the free-hand drawing technique advocated by the McGuffy Reading Clinic at the University of Virginia a more subtle guide to hidden defect and almost as simple to apply as Rychener's word list.

Objective

This analysis of 809 school children from the fourth to the sixth grade was made in an attempt to establish the role of reversal and its relation to other factors thought retarding influences on reading efficiency.

Method

The children studied are in Kanawha County, West Virginia. The schools were chosen to represent the neighborhoods of better economic status and by this minimize poor home conditions and poor nutrition as factors. The study was made in 1953 to the spring of 1954.

The following data were obtained:

Name—age—age on entering school—number of schools attended—grades repeated or skipped.

Screening audiogram of hearing. Twenty-foot Snellen chart for vision.

Vision was tested with whatever glasses the child might be wearing. Peripheral stereopsis was checked by stereomotivator.

Near-point of convergence, using pencil light and going to break—measurements quoted from bridge of nose and no correcting factors added.

Span of recognition of letters and numbers checked at 1/100 second and any reversals noted.

Five different checks of dominance were made on the eyes and hands and four on the feet.

For the eyes the child (1) sighted an imaginary rifle, (2) looked into a kaleidoscope, (3) winked, (4) looked through a hole in a paper held by the observer, (5) looked through a mock telescope.

For the hands the child was (1) given a knife and told to cut a cake, (2) given scissors and told to cut a paper, (3) given a ball to throw, (4) told to comb his hair, (5) given a pencil and asked to write.

For the feet the child was (1) told to hop, (2) told to step up on a step, (3) thrown a ball to kick, (4) asked to stand on tiptoe and weight shift noted.

The child was given 10 figures to draw free hand. He was given 10 symmetric patterns to copy from cards presented. The dominant directions of his drawing strokes were recorded.

Mental acuity was obtained from the school records (Otis Quick Scoring, Scale A) and checked by Kent Emergency Scale.

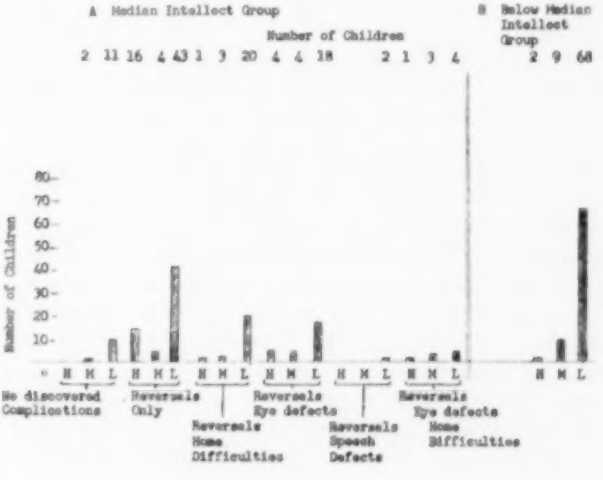
Reading ability was checked by (1) Gray Oral method—observers were our technicians, (2) Sangren-Woody Silent Reading Test, Form A, by home-room teachers.

With the Gray Oral test the speed with which the child read the first 199 words was checked by a stop watch without his knowing that speed was being checked. The material in this speed reading check was from first- to fourth-grade level, with approximately 50 words to each of the four paragraphs tested. The speed with which he read the Sangren-Woody test material was taken with his full knowledge that he was reading against time.

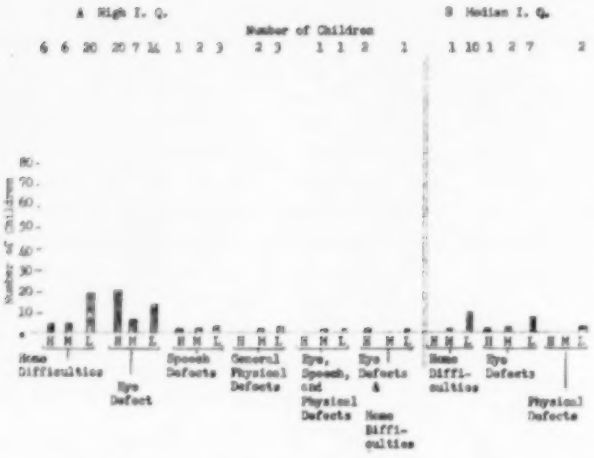
An interview with the teacher and principal was obtained on each child. The check list on behavior by Dr. William Moodie[16] was used as a guide for discussion.

Summary of data

Of the 809 children tested, 560 were median to high in intelligence and showed some stigmas of reversal. All those of median intelligence were separated from those of high I.Q. Any defect of hearing, sight, and speech, general physical handicaps, discoverable bad influence in the home, or manifest behavior problem were checked and the children catalogued accordingly. With sight, the near-point of convergence and how it was sustained and the peripheral stereopsis and span of recognition were also considered. After all this, there remained a group of 213 in which there was no assignable difficulty but reversal tendencies in their



Graph 2 (Shepherd). The symbols are the same as in Graph 1. Aside from following the pattern of Graph 1, these figures are not too significant. The children of poor intellect fell, as expected, into the poor reading group.



Graph 3 (Shepherd). No discovered reversing tendencies. The figures are not large enough to establish any significant trends. Some case might be made for the effect of home difficulties on reading score.

free-hand drawings. They were considered well-adjusted children from good homes whose sight, hearing, and general physical condition were all good. They were all definitely superior in intelligence.

Tested for reading ability orally by the Gray Oral test charts, 113, or slightly better than 50 percent, were below the expected grade level. Forty-nine were at the expected level and 53 were definitely above the expected level. Further analysis demonstrated that those whose free-hand drawings were done from right to left in more than half of the objects drawn showed a greater number of poor grades and slower speed of reading (graph 4, section 1).

Comparison of Gray Oral checks against Sangren-Woody shows a wide disparity on grade level. It must be remembered that Gray Oral is a pure test of reading ability while the Sangren-Woody covers comprehension, word recognition, organizational power, and other functions designed to give the teacher a broad look at the student. This is proper for school function but does serve as a combined intelligence and reading test. Giving the intelligence factor a footing in the test raises the over-all score and tends to gloss over a slow reader who is smart enough to skip and interpolate. For purposes of this paper, reading ability and intelligence must be kept as completely separate as possible.

The median-grade scores are more nearly comparable. The low-grade scores show a sharp depression in the Sangren-Woody tests as would be expected from a test that gives the student so many chances to do well, when he does do poorly the result is extreme.

An analysis of the conflicting high Sangren-Woody—low Gray Oral performers would indicate that time factors in the two tests are more nearly comparable, the slightly higher Sangren-Woody score being accountable to the student's knowledge that he was working against time, while in the Gray Oral he was not aware of being timed.

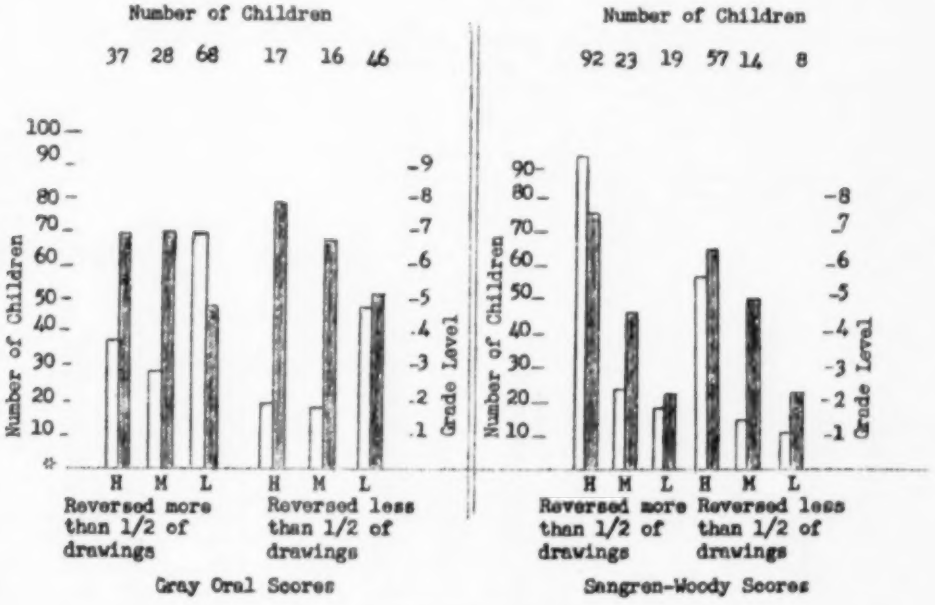
All of the superior intelligence group, unencumbered save for reversal tendencies, were checked for performance of grade and speed with regard to the dominant eye. Then they were again separated into those who reversed more than half of their free-hand drawings and those who reversed less than half their free-hand drawings. The fourth grade gave the right eye a slight edge, the fifth grade gave the left eye the edge, and in the sixth grade the eyes were practically identical. These findings were practically duplicated when all 809 were evaluated by the same comparative method.

The question of manifest home difficulties and behavior problems as a major source of reading deficiencies does not stand up clearly in this study. True, a group of 32 children of high I.Q. and no reversals show 20 of low grades where home difficulties are known to exist, but the groups of both median and high I.Q. showing both reversal tendencies and home difficulties conform closely to the pattern of distribution of those of high I.Q. who have no other discoverable encumbrances other than reversal tendency.

The eye defect analysis also conformed to the "reversal only" pattern except where no reversals were found and then the pattern was opposite. There is not a sufficient number presented to establish a significant trend.[13]

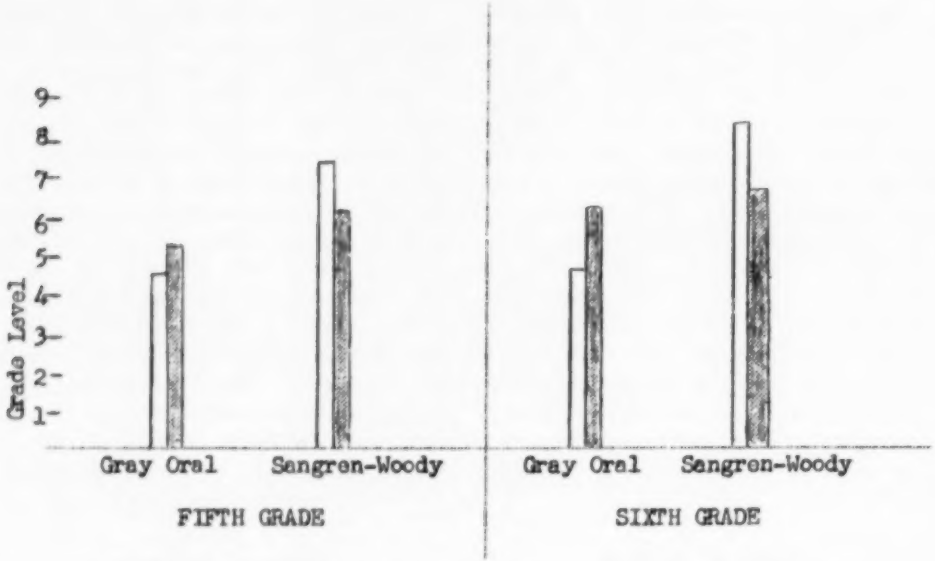
Seventy-nine of the 809 were definitely below the median I.Q. and no attempt was made to analyze their reading pattern.

From this mass of data one startling idea seems more than a suggestion, that right eye-left eye dominance and mixed dominance do *not* play a guiding role in reversal. The dominant reading directional pattern stands forth as a major factor, in itself enjoying an equal status with hand-eye-foot dominance and not led or influenced sharply by the other patterns. If this is so, then efforts made to alter the dominant eye patterns with the "Correct-Eye-Scope" and patching techniques are not pertinent to training. The instruction could better be concentrated on left-to-right pattern of word recognition. The subject merits a new look. We have not



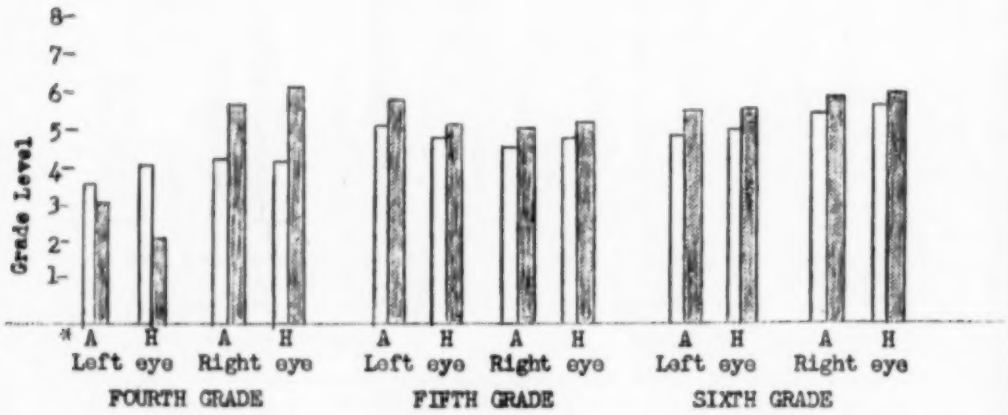
Graph 4 (Shepherd). Comparative reading grade levels and speed grade levels, superior intellect group. Reversers only, shown in Column 2, Graph 1.

The white bar represents the number of children making the grade achievement—high, medium, or low. These scores are calculated as in Graph 1. The solid bar represents the relative speed of reading transposed to grade level achievement for speed as given in the Sangren-Woody tests. The Gray Oral speeds were transposed to Sangren-Woody scoring terms. This graph shows chiefly that the speed of reading can be correlated between the two types of tests but that total reading scores are not comparable because of the facility allowed the student to skip, press, and interpolate in the Sangren-Woody tests. See the comment on this under "Statistical analysis of reading ability of entire test group," a footnote to Graph 7.



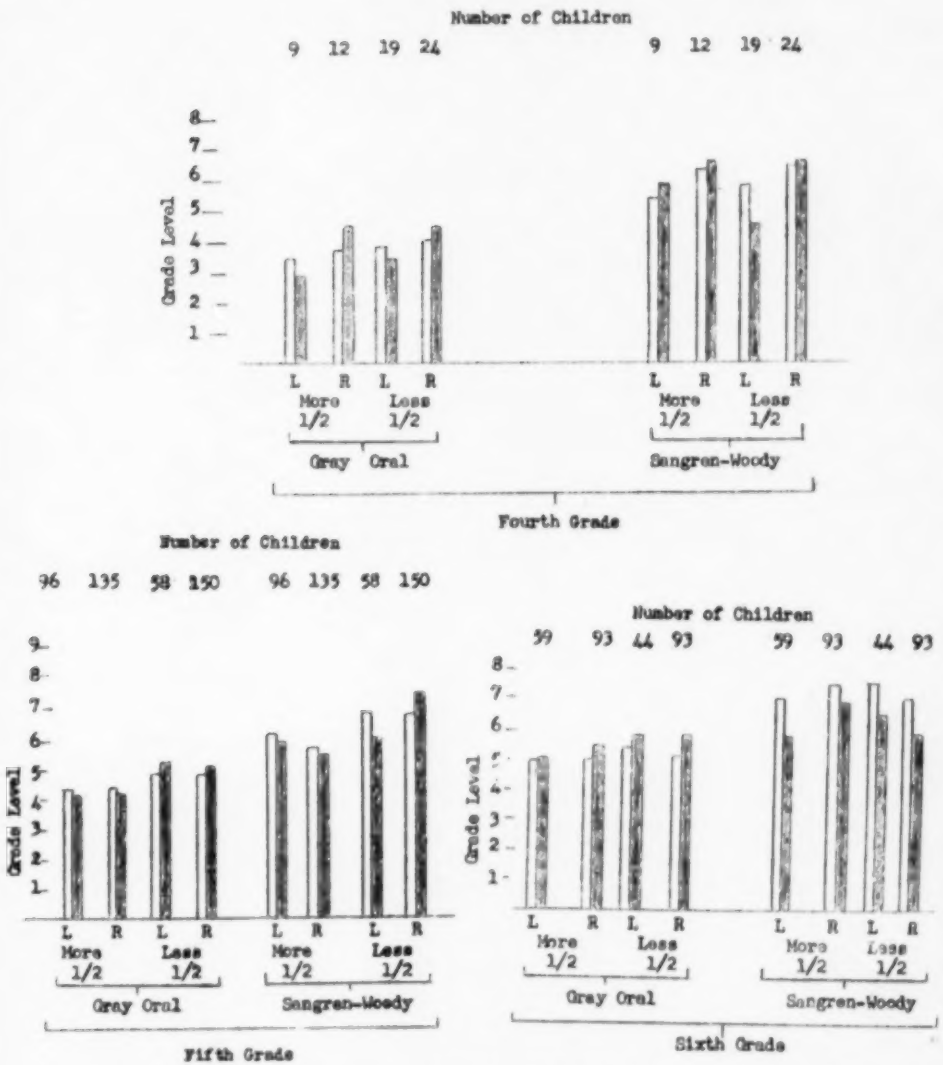
Graph 5 (Shepherd). Superior intellect group. Conflicting reports: low Gray-Oral and high Sangren-Woody scores.

The white bar represents the total reading achievement average. The solid bar represents the grade achievement in speed of reading—again all transposed to the Sangren-Woody scale for speed. This analysis covers 59 conflicting reports where the Gray Oral grade was low and the Sangren-Woody scores were high with the difference in grade level being one year or more. The graph serves to highlight the pressing effect manifest in the Sangren-Woody test and leads us to conclude that the Gray Oral is the better test for pure reading ability.



Graph 6 (Shepherd). Superior intellect group, reversers only. Effect of master eye on reading speed and grade level, Gray Oral test.

A—All the reversers in the group analyzed. H—Only those in the group reversing more than one half of their drawings. Left and right eye—group with left master eye and right master eye. This graph indicates that right- and left-eye dominance do not play a major role in controlling reading speed. This situation is exhaustively studied and compared in Graph 7.



Graph 7 (Shepherd). Entire group of 809 tested. Effect of master eye and mixed dominance* on reading speed and grade level.

The white bars represent grade achievement levels. The solid bars represent speed of reading scored by Sangren-Woody standards for speed and grade achievement level. L and R refer to dominant eye. More or less ½ refers to reversal pattern—whether more or less than ½ of drawings were reversed. Where no reversals were found they were scored with the "Less than ½" column.

* The mixed dominants were found to parallel the left-eye dominants so clearly that no distinction was attempted. Left-eye dominance and mixed dominance are therefore considered the same in this analysis.

been able to corroborate Berner's findings[3] but have checked only about 150 children by this method.

A distressing finding was the discovery of 80 youngsters out of the 809—practically 10 percent—stigmatized as being of low intelligence when by the oral method of mental tests they were actually superior. Their

Graph 7 statistical survey

John W. Breed, Ph.B.†

The averages of reading speed and grade level scores were organized to form 2^4 factorial experiments with all factors at two levels. The four factors in each case were (A) Eye Dominance, (B) Reversal, (C) Type of Test (Sangren-Woody and Gray Oral), and (D) Grade Achievement.

The analysis was made by the method shown in Brownlee, K. A., *Industrial Experimentation*, Second Revised Edition, pp. 84-90, Brooklyn, New York, Chemical Publishing Company, Inc., 1948, for a 2^4 complete factorial. The significant factors with their levels of significance are listed in tables which follow.

Before discussing each factor in detail it should be pointed out that the statistical analysis of the data confirms the gross observation of graphs and gives numeric measure to the significance of the factors. Significant interactions were not obvious from the gross inspection of the graphs.

First order effects

A—The immediate influence of left eye as measured against right eye dominance showed no significant influence on grade level or reading speed.

B—When students reverse more than half of their drawings, the grade levels and reading speeds are significantly depressed.

C—These two tests (Sangren-Woody and Gray Oral) show a sharply significant difference indicating that the results are not directly comparable measures of reading ability.

D—Grade achievement checks show a definite increase in reading efficiency with progress from fifth to sixth grade. This is an expected trend and serves to authenticate the accuracy of the other figures.

Interacting effects

B = D—Effect of grade advancement on reversal. This is a definite trend toward losing the reversal tendency as progress is made from the fifth to the sixth grade.

A = B = D—Eye dominance—reversal—grade achievement. A study of the interacting performance of the left eye-right eye, the reversing of more than one-half of drawings or less than one-half of drawings, and the grade level achievement shows that those with left dominant eyes hold longer to the pattern of reversal and show a resultant slowing effect on reading ability.

C = D—Type of test and grade achievement. Interactions with the Sangren-Woody compared to the Gray Oral tests indicate that there is in the Sangren-Woody a greater amount of pressing and bluffing in the achievement and time factors.

Table of actions

Factor	*df*	*Total Grade Achieved*		*Reading Speed Achieved*	
		Mean Square	*Significance*	*Mean Square*	*Significance*
		First Order Effects			
A—Eye dominance	1	0.0689		0.3306	
B—Reversal	1	0.5968	***	1.2656	***
C—Type of test	1	15.5828	***	5.1756	***
D—Grade Achievement	1	2.6651	***	1.4506	***
		Interacting Effects			
B = D	1	0.4000	**	0.7657	**
C = D	1	0.1701	*	0.5257	*
A = B = D	1	0.2233	*	1.2656	**
Residual Error	9	0.0404		0.1211	

Note: Three asterisks under column labeled "Significance" indicate a probability of less than one chance in one thousand for this result to have occurred by chance alone.

One asterisk indicates a probability of chance error of one in 20.

† Mr. Breed is employed by the Union Carbide and Carbon Corporation as a mathematician.

difficulty was an inability to read well enough to score properly on the standard school tests. Any child found substandard on screening should be exhaustively studied both physically and mentally before any final conclusion is made as to his mental capabilities.

Comment

The reading problem is highly charged with emotion, few if any give a neutral reaction when questioned on it. When a child reads poorly, the child, his parents, and his teachers begin a chain reaction to correct the deficiency. This reaction too often ends in an emotional tangle of anxieties involving all concerned to an astonishing degree. Good papers on the subject have dealt with the manifest problems of children who were known poor readers and about whom the chain reaction has long been in effect. As a result of this approach, the conflicting personalities of distraught parents and anxious children have received a major attention. Aside from Orton who gave extreme emphasis to the reversal pattern, most writers have tended to emphasize the emotions,[6, 8, 15, 17] or physical factors.[2, 10, 12, 13, 20]

The possibility that a psychologic block might underlie some of these problems and the possibility that "normal" school children might show this block were envisioned. This paper is an attempt to demonstrate the presence of a factor not physical and not emotional that might contribute to inability to read with ease.

The weak point is this presentation is the relatively superficial examination that we were forced to make on the child's psychic balance. Any examination beyond this, however, would have to be a most exhaustive analysis. There are no intermediate checks that will stand.

The ophthalmologist has a peculiar stake in the reading problem. At present and probably for some years to come he is the first to be consulted about the child who reads poorly or not at all. To feel that ruling out ocular deficiencies ends his responsibility is to condemn the child and his parents to needless search and further anxieties. No fancy equipment is needed to make a competent screening diagnosis of the child's problem and in many instances to offer a simple corrective procedure and understanding. Where strenuous anxiety overlays are present or mental retardation is evident then reference to psychiatrists can and should be made.

The tendency to reverse and the reading speed were most accurately predicted by the pattern of drawing. Here the subconscious leanings were most subtly expressed. The child might well copy formed figures of circles, squares, and block numbers as he had been taught, stroking the lines from left to right but then do the free-hand figures from right to left. These drawings will not only be stroked from right to left but will then be oriented in that direction, that is, arrows will point left and birds will be pictured flying left on the paper. Statistically, as well as in each individual test, this right-to-left pattern proved significant. We were surprised to find that the tachistoscope was relatively insensitive, showing up only the profound reversers.

As demonstrated in the graphs, not all reversers are slow readers and not all slow readers are reversers, but a sufficiently high percentage of poor readers demonstrated reversing as a contributing cause to make this a prime factor for investigation.

I believe that ophthalmologists can make a competent diagnosis of this reversing situation by the following tests:

First, a careful history will usually disclose the poor reading child to be good in arithmetic and quick to memorize things read to him. He is likely to be more irritable and nervous than other children in the family. The parents will often volunteer that he calls "saw" "was."

Second, letting the child draw with pencil and paper will furnish several facts. If he copies from left to right, he has been properly taught but, if his free hand material

goes from right to left, he has a definite tendency to read his words the same way. If all drawings go from right to left, he will usually be profoundly affected and in considerable trouble. The way he attacks the drawings, his tensions, unusual perspiration, and anxiety may show up to such an extent that the observer becomes immediately aware of the need for psychiatric care. A more relaxed child may well indicate a reverser but a relatively undisturbed one.

Mistakes at this point will be made by all of us but may I point out the common-sense fact that a beginning must be made on all these children and psychiatric screenings by experts in that field are at present a practical impossibility.

The third test is Rychener's word list. A grasp of the profundity of the reversal pattern will show up here. The child's relative speed with words, his tendency to reverse the middle syllables of words and lose their meanings, and again his nervous tensions may be observed.

Finally, the Kent Emergency Scale tests for intelligence will give a surprisingly accurate concept of the child's mental acuity. Consultation with and guidance by a qualified phychiatrist or psychologist skilled in testing is necessary before undertaking the test but a reasonable skill in its use is not difficult to acquire and the help gained from it is certainly worth the effort.

Knowledge gained from these simple tests will permit the ophthalmologist to reassure the parents and the child in many instances. Getting the parents to recognize the child's problem and co-operate with the child's teachers will often serve to circumvent a serious psychiatric upheaval. One has to see to believe the family tensions buit up around a child who reads poorly. Teachers often sense it but are powerless to tell parents to let the child alone.

We as ophthalmologists can tell the parents just that and promote a new feeling of understanding between parents and teachers. We may well get credit for saying what a teacher has long known, but the benefits to the child who has home pressures lifted from his troubled head make other considerations trivial.

A study is needed to find the interaction of speech difficulty and reversal or reading disability.[23] There is a distinct possibility that the teaching of phonics might clear up a high percentage of both problems. We are aware of a subtle, subclinical speech fault in a high percentage of the patients we have examined for reading disability but have not had the technical help necessary to reduce this to a definite figure. A re-evaluation of teaching methods could find the function of sound, sight, and touch, and how the fusion of these faculties might give the student a maximal appreciation of words and syllables.

The work of Dolch and Bloomster[25] would indicate that phonics, as such, need maturity beyond the beginning reader. But does this need for maturity preclude the possible use of good phonic appreciation of the words to be used, associating the sound with sight and touch? We have gone to lengths in the past to make the student read without mouthing his words or touching the print. This to my thinking ignores the fact that the reversing child needs to hear the word to know it and to touch it to keep his mind oriented. We should explore the possibility that there is a stage in growth, a neural development pattern, a maturity that permits the ready recognition of the whole word or phrase. It may well be that failure to recognize this is as harmful to reading development as the failure to recognize the reading readiness pattern.

Present-day teachers are inching back to phonics or, as one writer put it,[24] using the best of both phonic and word as a whole method of recognition. We as ophthalmologists can and should take a hand in urging our school systems to take a positive stand on this matter, setting up a sensible plan of attack. We should and must void this random attack on a problem so vital to the education of our children.

Finally, we ophthalmologists should look appraisingly into the school performance of the children we examine. We have many opportunities to help parents make good students out of intelligent children who might otherwise drift into mediocrity.

Conclusion

The majority of the children tested showed some reversal pattern. There is a definite correlation between the degree of reversal and the reading speed of the so-called normal cross section of students, that is, the greater the tendency to reverse, the slower the reading speed. There was no correlation between reading speed and eye dominance as such, but, on studying interactions, those of left-eye dominance showed a discernible tendency to prolong a reversal pattern. The reading directional pattern stands out as a major dominant force in its own right. It is influenced by the dominant eye but not dominated by this influence. Mixed dominance and left-eye dominance were so consistently parallel that no conclusions were assignable to mixed dominance that are not covered by left-eye dominance.

Reversing is sufficiently prevalent as a factor in poor reading (50 percent or more of the highly intelligent students with no other discoverable cause for poor reading) to justify the ophthalmologist taking an active part in diagnosing its presence and urging the school system to a studied, purposeful attack for its control.

1106 Virginia Street (1).

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SIMULTANEOUS CONSTRUCTION OF THE SUPERIOR PALPEBRAL FOLD IN PTOSIS OPERATION

BURGOS T. SAYOC, LIEUT. COL. (MC) PATC
Fort William McKinley, Rizal, Philippines

Surgical correction of blepharoptosis is still considered an unsolved problem due to the inherent limitation of all ptosis operations and to the complicated nature of ptosis. For these reasons, surgeons do not get entirely satisfactory cosmetic and functional results.

In most ophthalmic articles and textbooks, special emphasis is placed on minute details of surgical procedure to restore function and most often the cosmetic correction is less emphasized. It is for this very reason that this article is written.

Usually, surgical operations for ptosis come under one of three groups:

1. The use of occipitofrontalis for lifting the lid (Friedenwald-Guyton;[7] Weiner's fascia lata sling;[2, 3] Hunt-Tansley.[3]

2. The use of the superior rectus muscle—Open Motais;[2] Dickey's fascia lata sling to the superior rectus;[3] Tramor operation;[2] Berke's.[7]

3. Shortening of the levator palpebrae muscle (Blaskovic's;[2, 3] Johnson[7]).

No matter which of these is used, the same technique for the construction of the superior palpebral fold can be followed.

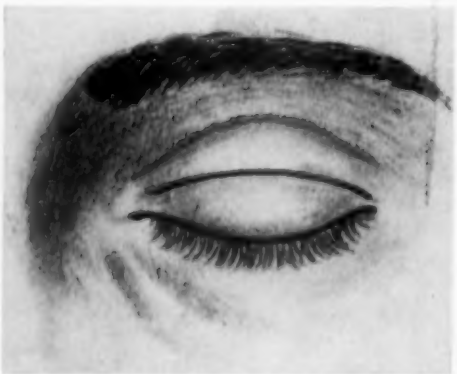

Fig. 1 (Sayoc). Diagram showing a line drawn on ptotic lid corresponding to the height of the superior palpebral fold in the sound lid, in case of unilateral ptosis.

ANESTHESIA

The operation may be done under either local or general anesthesia. If local, a retrobulbar injection of two-percent novocaine with a few drops of adrenalin (1:1,000) is first given, and then the lid is infiltrated with the same solution.

TECHNIQUE

In unilateral cases, the superior palpebral fold of the sound eye is measured in its middle, temporal, and nasal portions to conform with the line drawn on the skin of the ptotic lid (fig. 1) for possible site of incision. This line is usually six to eight mm. high at the temporal and nasal ends. A modified chalazion forceps is made to grasp the eyelid just below the incision line.

Holding the forceps with the left hand, an incision is made in one long-drawn stroke extending from the nasal to the temporal ends of the lid, with the operator on the head side. The incision cuts through the skin, subcutaneous tissue, and orbicularis down to the tarsus (fig. 2). A narrow strip of orbicu-

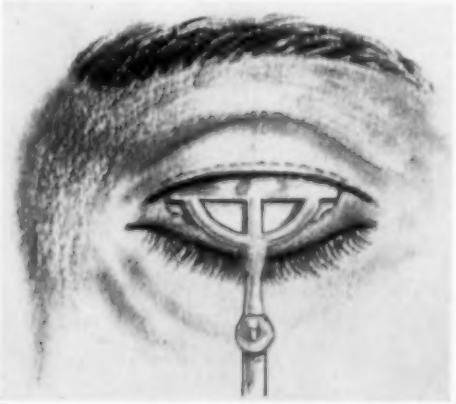

Fig. 2 (Sayoc). Diagram showing incision which is made through the skin, subcutaneous tissue, and orbicularis down to the anterior surface of the tarsal plate. Note the application of Sayoc lid forceps which fixes the lid for incision.

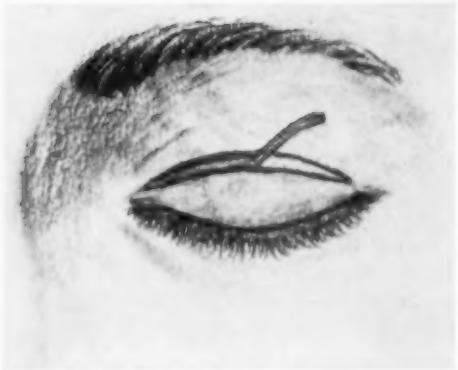

Fig. 3 (Sayoc). Diagram showing excision of a narrow strip of orbicularis (one to two mm.), extending from the nasal to the temporal ends of the incision.

laris, from one to two mm., extending from the nasal to the temporal ends of the incision, is excised (fig. 3). The lower flap (fig. 4) is dissected downward in one layer to include the skin, subcutaneous tissue, and orbicularis separating it from the anterior surface of the tarsus along its middle half to about two mm. from the edge of the lid.[2, 3] The wound is packed with cotton strip, soaked in adrenalin solution (1:1,000) to control capillary bleeding.

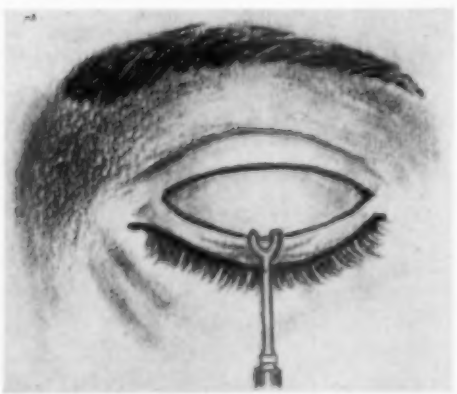

Fig. 4 (Sayoc). Diagram showing dissection of lower flap downward in one layer to include the skin, subcutaneous tissue, and orbicularis, separating it from the anterior surface of the tarsus along its middle half to about two mm. from the edge of the lid.

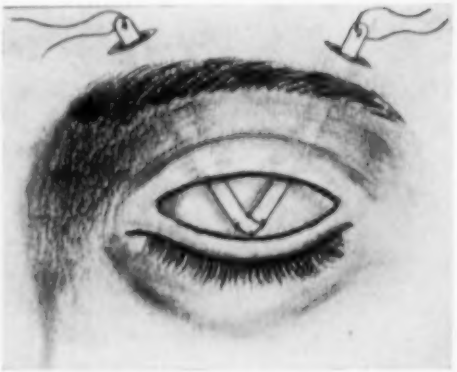

Fig. 5-A (Sayoc). Diagram showing correction of ptosis with the use of fascia lata sling from the tarsus to the occipitofrontalis (Weiner).

Detailed description of the operative technique for the correction of ptosis under the three groups of procedures can be found in different textbooks of eye surgery[1-4] and journals[5-8] hence the discussion is purposely omitted in this article (figs. 5-A, B, and C).

After the fascia lata sling is attached from the tarsus to the frontalis, or the superior rectus to the tarsus, or the levator palpebrae shortened to correct the ptosis, simultaneous construction of the superior palpebral fold is done as follows:

With a 6-0 braided or plain catgut, an eye noncutting needle makes a bite to the dermal layer of the lower skin flap (fig. 6) and

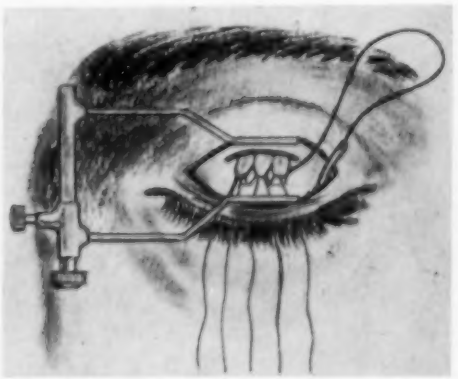

Fig. 5-B (Sayoc). Diagram showing the use of the superior rectus muscle (in three tongues) sutured to the anterior tarsal plate (Johnson).

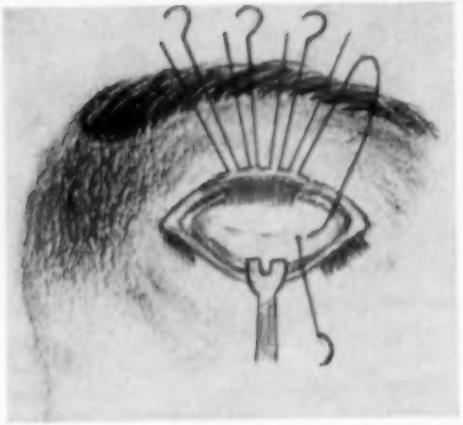

Fig. 5-C (Sayoc). Diagram showing resected levator sutured to the anterior superior tarsal plate (Johnson).

anchors it with a small bite on the anterior surface of the exposed tarsus, care being taken that the needle does not make a bite through the thickness of the tarsus. Three to five interrupted burried sutures are then made, encouraging adhesion of the dermis to the tarsus. The incision is then closed using 6-0 black silk interrupted stitches (fig. 7).

Postoperative Care

The eye is dressed with sulfacetamide ointment and eyepad. In applying the dressing (1) the cornea must be well protected and (2) there must be no traction or pull on the

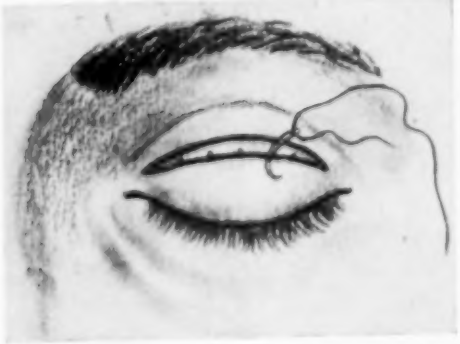

Fig. 6 (Sayoc). Diagram showing suturing of the dermal layer of the lower skin flap of the anterior exposed surface of the tarsus.

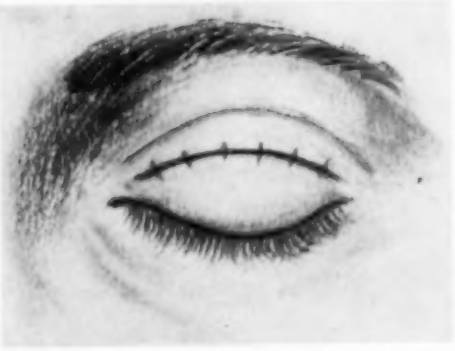

Fig. 7 (Sayoc). Diagram showing the closed incision.

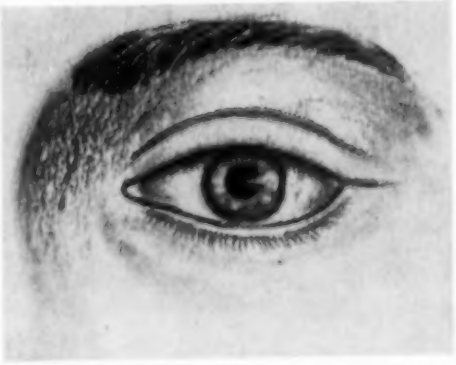

Fig. 8 (Sayoc). A sketch of an eye with a superior palpebral fold simultaneously constructed during ptosis operation.

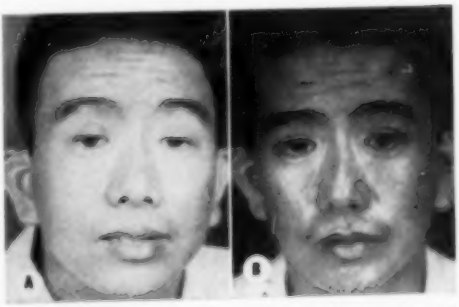

Fig. 9 (Sayoc). Bilateral ptosis with resection of levator. (A) Before operation. (B) Three weeks after operation. Note the superior palpebral fold.

upper lid which will throw tension on the stitches placed to hold it in place. This is accomplished by covering the eyeball with the lower lid. A broad piece of adhesive plaster is then fastened well down on the cheek. A light gauze dressing is placed over the upper lid and brow. When the cheek is pulled up by means of the adhesion strip and is fastened to the forehead, it will effectually protect the eye and produce no pull on the lid sutures. This means of closure is required for only a few days.

Demerol tablets and APC tablets are both given as required for pain. The suture on the fold is removed on the fourth day.

Edema of the lid normally disappears on the seventh day. The result of the ptosis operation is noticeable after four to six weeks (fig. 8).

Conclusion

This paper is presented to stress the simultaneous construction of the superior palpebral fold in the surgical correction of ptosis to enhance cosmetic results (fig. 9).

First Station Hospital.

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INCOMPLETE PERIPHERAL IRIDECTOMY

Two instructive cases

Tayloe Gwathmey, M.D.
Orlando, Florida

The modern mechanical theory of the etiology of narrow-angle glaucoma has been recently set forth, notably by Chandler,[1] and Barkan.[2] This theory has been widely accepted in this country but can hardly be said to be so well established as to be nowhere the subject of controversy. It is the purpose of this paper, therefore, to report two cases which greatly reinforce the arguments of those who hold that the pushing forward of the iris by the aqueous behind it is a key factor in the production of narrow-angle glaucoma.

The obstruction to the flow of the aqueous through the nonpathologic pupil may well require much speculation and study before all its secrets are elucidated. The configuration of the posterior surface of the iris at the pupillary border may explain why some eyes with shallow anterior chambers have narrow-angle glaucoma and some do not. The effect of miotics on this configuration should be a fruitful, though difficult, study. The purpose of this paper, however, is not speculation, but the reporting of an interesting accident.

We know that, in certain eyes without any pathologic alteration, the iris is pushed forward by the aqueous behind it and assumes a domelike posture, called physiologic iris bombé. The only reasonable conclusion from this phenomenon is that the aqueous cannot

flow freely through the pupil because the iris at its pupillary border lies flat and relatively watertight against the anterior surface of the lens. When such an iris bulges forward sufficiently to occlude the angle, narrow-angle glaucoma results.

In order to provide for the free flow of aqueous from the posterior into the anterior chamber, the peripheral iridectomy or iridotomy has been widely used, and has been widely successful if done before pathologic changes have become established.

Chandler,[1] in order to lessen the danger of trauma to the lens capsule, has recommended the use of toothless iris forceps for this iridectomy, and I have followed his recommendation with good results. But when toothless forceps are used, there are no teeth to pierce the rubberlike pigment epithelium of the iris. As a result, it is possible for the scissors to remove the stroma of the iris and leave the pigment epithelium intact. This happened to Dr. Chandler on September 25th and to me on November 18th. The resulting bulging of the intact pigment epithelium was such incontrovertible evidence of the obstruction to the flow of aqueous through a nonpathologic pupil that Dr. Chandler kindly sent me the description of his case with permission to include it in this report. The second case was, fortunately, a very early uncomplicated case of narrow-angle glaucoma, and is especially instructive.

Case reports

Case 1 (Dr. Chandler's Case)

A. L., aged 57 years, eight months ago had an attack of acute glaucoma in left eye. He was treated with miotics and tension was said to return to normal. The patient was apparently not told the nature of his trouble and, after a few days, discontinued drops. Six weeks ago he was seen by another ophthalmologist with a history of pain and blurred vision in the left eye of three days' duration. Tension was found to be 72 mm. Hg (Schiøtz), but promptly fell to normal under intensive miotic treatment. He continued to use a miotic and tension was said to be fairly well controlled. He was referred to me for further treatment. Findings on August 30, 1954, were as follows:

Vision: O. U., 20/20. Anterior chambers quite shallow. Right pupil, three mm., reacts to light. Media clear, disc normal. Left pupil, three by four mm., fixed to light. Media clear. Disc showed bending of all vessels at the margin, but no excavation. Tension: R. E., 17 mm. Hg; L. E., 40 mm. Hg (Schiøtz).

Gonioscopy, right eye. Angle everywhere extremely narrow. Below the iris seemed to be in contact with the trabecular wall, elsewhere open.

Gonioscopy, left eye. Angle everywhere extremely narrow. It appeared to be definitely open from 12- to 2-o'clock positions. There was a small open area at the 3-o'clock position, probably open from the 5:30-o'clock position clockwise to the 9-o'clock position. From the 9- to 12-o'clock position, the angle was either closed or open the merest slit.

On September 25, 1954, a peripheral iridectomy was done at the 1:30-o'clock position in the usual manner through an ab externo incision with a scleral suture. After making the incision and before doing the

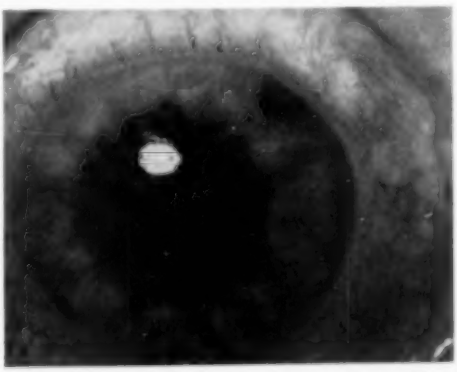

Fig. 1 (Gwathmey), *Case 1.* Left eye. This photograph shows that a sizable piece of iris stroma was removed, although the pigment epithelium remained intact.

iridectomy, a cyclodialysis spatula was passed upward and downward from the incision in the angle of the anterior chamber in an attempt to free anterior synechias. The iris was grasped near the periphery with smooth forceps, pulled out, and a small piece excised. The anterior chamber was formed with air.

On September 27th, a peripheral iridectomy was done on the right eye.

The postoperative course was uneventful, and the patient was discharged on September 29th. Home treatment consisted in 0.5-percent cortisone, four times a day, and 10-percent neosynephrine, once daily. He returned to the care of the referring ophthalmologist.

On November 5, 1954, the patient was re-examined.

Right eye. Tension, 16 mm. Hg (Schiøtz). Anterior chamber seemed deeper than preoperatively. Gonioscopy showed the angle to be wider than preoperatively and completely open except for one small zone from the 6- to 7-o'clock positions. The peripheral iridectomy showed a good opening.

Left eye. Tension, 32 mm. Hg (Schiøtz). With the slitlamp beam, the angle seemed more narrow than in the right eye. Gonioscopy showed the angle to be open from the coloboma down to the 3-o'clock position; closed from 3- to 4-o'clock. From the 4- to 7-o'clock position the iris covered at least a part of the trabecular zone. More of the trabecular zone was exposed from 7- to 10:30-o'clock, but the scleral spur could not be seen. From the 10:30-o'clock position up to the edge of the coloboma the angle was well open. In the coloboma the pigment epithelium was seen to be intact and bulging forward in domelike fashion through the opening in the stroma so as almost to touch the cornea.

On November 20th, with a Haab-type discission needle the pigment epithelium bulging through the coloboma was incised. The patient was discharged the following day and re-examined on December 21st. The right eye was unchanged. Tension was

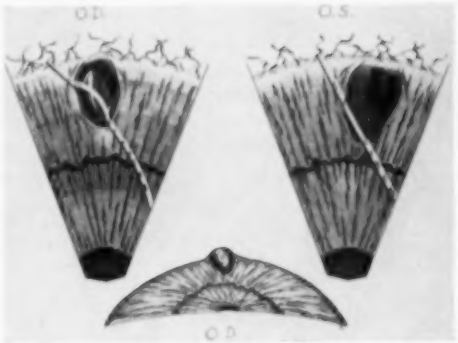

Fig. 2 (Gwathmey). *Case 2.* At left is the iris of the right eye after the incomplete peripheral iridectomy. The slitlamp beam indicates the bulging of the membrane and the domelike posture of the iris. Below is a sketch of how this iris would have appeared on gonioscopic examination. Unfortunately the palpebral aperture was too small to admit an Allen gonioscope. In this lower sketch the bulging was slightly exaggerated by the enthusiastic artist (a portrait painter kind enough to make his first excursion into medical illustration).

At right is the iris of the left eye after the partially incomplete iridectomy. The slitlamp beam indicates the flatness of the remaining portion of the posterior pigment layer, and also indicates the absence of a domelike posture of the iris.

18 mm. Hg (Schiøtz). In the left eye, tension was 32 mm. Hg. Gonioscopically the angle looked much as it did at the previous examination, except that where the angle was completely open it appeared wider than before. In the coloboma there was a good opening in the pigment epithelium. The remains of the pigment epithelium were flat and on the plane of the iris. Pilocarpine was prescribed and the patient was sent back to the referring ophthalmologist.

Case 2 (my case)

The patient was a 49-year-old white woman, whose mother had lost all her vision from glaucoma. At a routine examination four years earlier it was noted that her corneas were small, and the anterior chambers shallow. There was no evidence of glaucoma at that time, although no provocative test was done. In April, 1954, another routine examination was done and there was still no

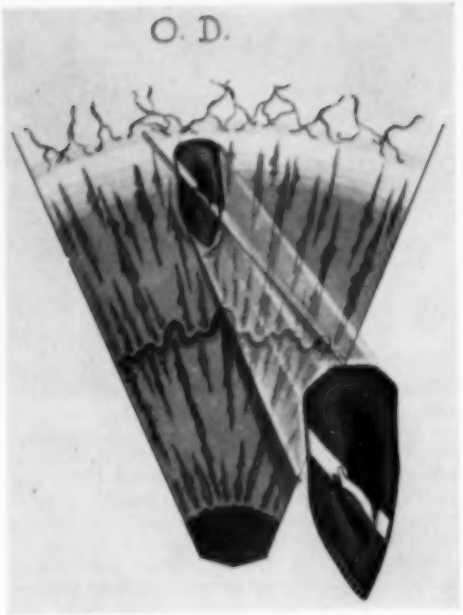

Fig. 3 (Gwathmey). *Case 2.* This shows the iris of the right eye after puncture by transfixing the bulging membrane until the bridge of membrane parted. The slitlamp beam indicates the absence of a domelike posture of the iris, and the higher magnification of the membrane shows the nature of the opening that was made. (Three weeks after the puncture this membrane was still not as flat as in the other eye, indicating that it may have been permanently stretched by the bulging.)

evidence of glaucoma and the tension did not rise perceptibly after ephedrine dilatation. In retrospect it is clear that a dark-room test should have been done at that time.

On October 1, 1954, the patient had very temporary fogging of the vision in the right eye. Fortunately she was sufficiently well informed and alert to suspect the significance of this and came in without delay for observation. At that visit the tension was normal to fingers. Her palpebral aperture was too small to admit the Allen gonioscope, but her angles were seen to be very narrow on slitlamp examination. A dark-room test was done on October 6th with the following results: Schiøtz tension after 30 minutes in bright daylight: R.E., 33 mm. Hg; L.E., 23 mm. Hg. After 60 minutes in complete darkness: R. E., 43 mm. Hg; L. E. 28 mm. Hg.

A diagnosis of narrow-angle glaucoma with physiologic pupillary block was made, and was confirmed by the quick fall of the tension following the prescription of miotics. (After seven days on two-percent pilocarpine, three times daily, tension was: R.E., 15.5 mm. Hg [Schiøtz].)

Accordingly, a peripheral iridectomy was performed on the right eye on November 18th, using the scratch incision technique with scleral suture, and using a toothless forceps, and removing as little iris as possible. The postoperative course seemed quite satisfactory so the left eye was similarly operated six days later.

There were no complications but, at the first postoperative office visit, the slitlamp revealed that, in the right eye, the iridectomy, though making a nice V-shaped excision of the whole iris stroma, had left entirely intact the pigment epithelium of the iris. In the left eye, much of the pigment epithelium was also left but two holes through it (fig. 2, left eye) provided adequate drainage of the aqueous. It was very interesting to observe that in the left eye this membranous pigment epithelium of the iris was flat and not loose, or flaccid, or wavy. In the right eye it bulged forward through the hole that had been made in the iris stroma.

The behavior of these two eyes, especially

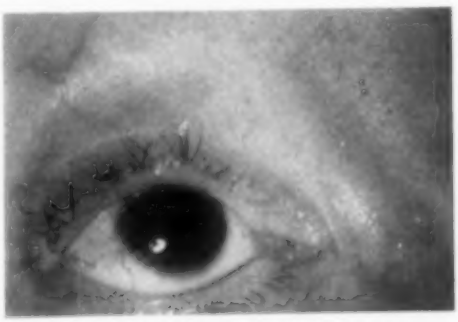

Fig. 4 (Gwathmey). *Case 2.* Right eye. Showing V-shaped peripheral iridectomy before membrane was punctured.

Fig. 5 (Gwathmey). *Case 2.* Left eye. Showing peripheral iridectomy.

the right eye with the intact membrane, was very instructive and merits being described in some detail.

Take first the left eye in which the iridectomy was functioning. Nine days after the operation the Schiøtz tension was 17 mm. Hg with two-percent pilocarpine twice daily. Upon discontinuing the pilocarpine on the 15th postoperative day no rise occurred in the ocular tension. It remained 17 mm. Hg on December 11th; was 17 mm. Hg on December 14th and December 16th; was 15 mm. Hg on the 18th and 30th; 17 mm. Hg on January 6th and 11th, and 20 mm. Hg on January 27th.

Now take the right eye in which the membrane was intact. Fifteen days after operation Schiøtz tension was 24 mm. Hg while using pilocarpine twice daily. Six days later it was 26 mm. Hg. The pilocarpine was changed to three times daily but two days later Schiøtz tension was still 26 mm. Hg. The pilocarpine was changed to four percent but three days later the Schiøtz tension was 29 mm. Hg. Meantime the membrane had definitely increased the extent of its bulging. At this point eserine, 0.25-percent ointment at night was added to the four-percent pilocarpine three times daily and two days later the Schiøtz tension was 21 mm. Hg. The bulging of the membrane did not appreciably decrease, however. Two days later the Schiøtz tension was 17 mm. Hg and the appearance of the membrane was the same. At the time Figure 2 was made by the artist the Schiøtz tension was only 15 mm. Hg. The probable explanation for this is that, although the pigment epithelium of the iris is certainly an elastic membrane, it can be stretched to a point from which it will not (immediately, at least) return to normal.

On January 6th, 48 days after the iridectomy, Schiøtz tension in the right eye was 23 mm. Hg, the angle was very narrow, and the iris was in the domelike posture which is characteristic of pupillary block. The iris of the left eye, by comparison, was not in this domelike posture but was cone-shaped.

On January 6th, a Wheeler discission knife was used to puncture the bulging membrane. The knife was inserted at the limbus at about the 10-o'clock position. In spite of the fact that the iris was considerably thicker than the average, this membrane protruded so far in front of the plane of the anterior surface of the iris that it was possible to enter it with the knife in front of the iris, and emerge at a second point and continue the progress of the knife with its tip still in front of the iris.

This is mentioned to indicate that the pressure on this membrane from behind, pressure which could not possibly have been present without physiologic pupillary block, was not merely present but was very considerable and was not partially the product of an enthusiastic observer's imagination.

The pupillary block was physiologic because there was no pathologic alteration of either eye, past or present. It was formidable because it was sufficient to force aqueous through the small hole resulting from the puncture at such a rate that the domelike posture of the iris was observed to deflate so rapidly that the motion of the iris away from the cornea was visible to both the operator and a colleague assisting.

Following the puncture of the membrane, the course of events was both instructive and gratifying. No pilocarpine was used postoperatively and, on the fifth day after the puncture Schiøtz tension was 18 mm. Hg.

Three weeks after the puncture, with no miotic used in either eye since the puncture, a dark-room test was performed, with these results: Schiøtz tension after 30 minutes in bright daylight: R.E., 21 mm. Hg; L.E., 20 mm. Hg.

After 60 minutes in complete darkness: R.E., 23 mm. Hg; L.E., 22 Hg.

Comment

Observations on the behavior of the pigment epithelium of the iris in the absence or weakness of the stroma have of course been made before.[3-5] But here we have an opportunity to study this behavior in cases of known glaucoma and, in Case 2, in a case of early narrow-angle glaucoma without anterior or posterior synechias and without any other pathologic finding. The bulging of the pigment epithelium so clearly affirms the importance of obstruction to aqueous flow at the pupil in narrow-angle glaucoma as to need no comment.

From Case 2 the conclusion seems warranted that the removal of a piece of iris stroma alone failed to ameliorate the glaucoma, while thereafter the establishment of a good opening between the posterior and anterior chamber apparently cured the glaucoma.

The use of toothless forceps, which do not perforate the pigment epithelium, undoubtedly predisposes to the development of this complication, and it is difficult to understand why it has not happened more frequently. Since it is an extremely instructive and also an innocuous complication, it would seem that until and unless it does occur more frequently, toothless forceps should continue to be used for peripheral iridectomy in early glaucoma.

417 East Robinson Avenue.

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SOLAR CHORIORETINAL BURN*

Tulsi Das, F.R.C.S., M. S. Nirankari, F.R.C.S., and M. R. Chaddah, M.S.
Amritsar, Punjab-India

Visual disturbances caused by looking into a solar eclipse have been known since the time of Socrates. Galen was well aware of the harm done to the eyes by watching the solar eclipse. History tells us that Galileo injured his eyes by looking at the sun through his telescope. In the Punjab villages the elders still advise watching the reflection of the sun in a basin of water containing a pinch of turmeric, or through a red cloth. In spite of all this knowledge handed down through ages, hundreds of eyes are injured at each eclipse of the sun.

Present study

A series of 37 patients with macular burn were observed after the solar eclipse of February 25, 1952. In every case, in addition to a detailed history, vision was recorded, the field of vision was plotted, and a detailed examination of the eyeground was carried out. Out of 63 affected eyes, retinoscopy was

* From the Department of Ophthalmology, Medical College.

done in 55. Most of the cases were followed up to 10 months; a few did not visit the hospital for the second time.

Clinical observations

The incidence of lesion was found to be highest between the 11- to 30-year-old group, comprising 83.78 percent of all the cases; 10.81 percent fell in the next age group—31 to 40 years. There was one case in each of the successive groups, between 41 to 50 years and 51 to 60 years. Incidentally, it may be remarked that 26 of the cases were males and 11 females.

Almost everybody complained of diminution of vision. General fogginess of the vision was complained of in 16 cases, while positive scotoma was present in 21 cases—black in 13, black surrounded by red in one, red surrounded by yellow in one, black surrounded by yellow and red in one, red surrounded by yellow and blue in one, yellow scotomas in two, and luminous scotomas in the other two. Five of these patients said that the scotoma was revolving.

Two patients complained of red vision and one of yellow. Six patients said that the electric lights appeared red to them. None of them complained of lacrimation or photophobia, pain in the eyes, micropsia, macropsia, or nyctalopia. The previous history was not relevant in any case except one; the patient had complained of headache and distortion of objects some years back.

Out of the 63 affected eyes, 35 were right and 28 left. The lesion was bilateral in 26 cases. Examination of the anterior segment of the eye did not reveal any abnormality except a dilated pupil in one case.

Vision varied between a poor 6/6 and 6/60, the average being 6/12. Retinoscopy was done in 55 affected eyes—14 were emmetropic, 37 had hypermetropia of low degree, and four showed myopic astigmatism of 0.25 to 0.5 diopters. None of the eyes were aphakic.

Only three cases showed a relative central scotoma. In one case, it was an irregular defect which extended between 10 and 20 degrees. In the second case it was roughly triangular in shape, extending almost from the center to 15 degrees. In the third case, a transversely oval scotoma extended between five and seven degrees.

Ophthalmoscopically, the macular lesions could be well compared with the various stages of burn of the epithelial structures, like skin and mucous membrane. The following types of pictures were seen depending upon the severity of the lesion.

1. *Normal macula.* There were no obvious objective signs and ophthalmoscopic examination showed normal macula. This type of lesion, due to excessive stimulation of the sensory end-organs in the retina, might be compared clinically to skin exposed to the sun for a short time without showing any erythema but still giving rise to an uncomfortable burning sensation.

In the macula, the exposure to the visible rays might have produced an excessive photochemical reaction which transgressed the normal physiologic limit; this might be responsible for the various subjective symptoms. However, it might be due to the production of toxic exudation not visible by ophthalmoscope.

In this series only three eyes had this type of lesion. All three were left eyes. The patients had watched the sun eclipse binocularly, probably fixing more with their right eyes. All three had visible ophthalmoscopic lesions in their right eyes. There were marked subjective symptoms, such as black and yellow spots in front of the central field, blurred near vision, and positive black scotomas oscillating round the central axis.

In one case the left eye became symptom free and the vision was 6/6. In a second case there was general fogginess in front of the eye and the vision was 6/6−. In the third case the vision was reduced to 6/12 and there was fogginess in front of the eye. After three months, when again examined, the vision had recovered to 6/6−. In the last two cases, the patients complained that vision

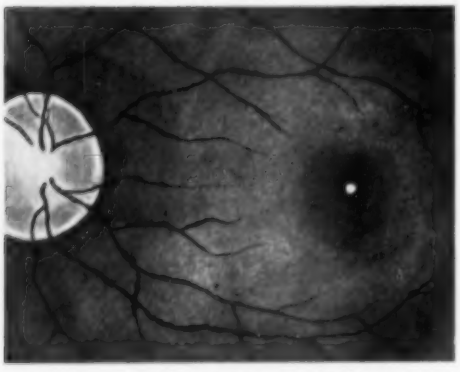

Fig. 1 (Das, Nirankari, and Chaddah). Well-defined fovea surrounded by intense hyperemia.

was not the same as before the incident, which shows that improvement of vision is not the only criterion of recovery. The same observation has been made by Amsler (1949).

2. *Erythema stage.* This type of lesion could be compared to the first-degree burn of the skin. The central foveal reflex was surrounded by a dark-red, or brownish-red, roughly circular area about one-fifth the size of the macula (fig. 1). This type of lesion was present in 18 eyes, 10 right and eight left. The brown-red, circular area was due to congestion of the choroidal and retinal vessels. It took its circular form partly from the peculiar arrangement of the macular blood supply and partly from the shape of the traumatizing agent (the circular focused light of the sun's image).

In four eyes the central foveal reflex was normal. In the rest of the 14 eyes, it was two to three times its normal size and fuzzy in appearance, due to some degree of swelling produced by hyperemia.

3. *Edema-erythema stage.* This stage of macular burn could be compared to the second-degree skin burn. There was a central edematous area, the color of which varied from pale yellow to dark brown, depending upon the time elapsed between injury and examination. This area in turn was surrounded by erythematous tissue, just like a skin blister surrounded by an erythematous area (fig. 2). This type of lesion was seen in 34 eyes, 20 right and 14 left.

The foveal area was sharp and well defined in five eyes, indistinct and broadened in the rest. In five eyes the edematous tissue was raised above the surrounding area, the foveal reflex being seen as the mouth of a crater and giving the impression of depth. Instead of being in the center of an edematous area the foveal reflex was on the temporal or nasal edge in 11 eyes—six right and five left. This could only be explained by eccentric fixation at the time of observance of the eclipse. The ophthalmoscope showed a central edematous area surrounded by a brownish-red, circular area, the fovea in the center of the edematous area being the bull's eye.

4. *Partial macular atrophy.* Signs of atrophy were present in eight eyes at the time of the first examination. Four eyes showed pigmentary stipplings with gray spots; in the others, there was no pigmentary change.

All these patients reported for examination from one to eight months after the incident. Seven eyes had an intensely red crescentic area at the macula (fig. 3). It was not possible to say whether it was due to hemorrhage or marked congestion of the choroid seen in sharp contrast to the sur-

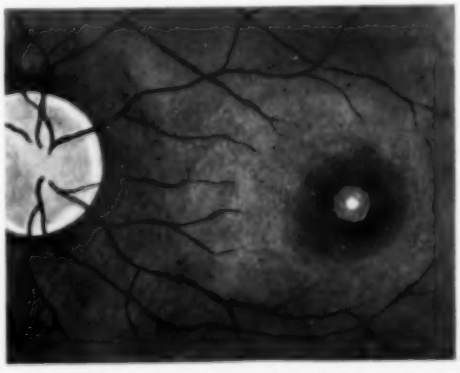

Fig. 2 (Das Nirankari, and Chaddah). Broadened and indistinct fovea surrounded by edematous and hyperemic areas.

rounding gray area. In one patient, who showed bilateral lesions but without any gross disturbance of vision (6/9—), it was conceded that the intensely red area could be due to choroidal congestion, as it is a universal experience that central hemorrhage causes gross disturbance of central vision which was absent in this patient.

One of the eyes included in this group showed a delicate semitransparent membrane in front of an intensely red area and extending into the vitreous. This could be a part of the wall of the blister which probably burst.

In addition to the eight eyes already mentioned, six eyes developed atrophic spots during the follow-up period extending from six weeks to six months.

A close follow-up, extending over a period of 10 months, revealed the following sequence in the ophthalmoscopic picture of the macula:

Twenty-four hours after the injury, a fully developed picture of grade 2 and 3 lesions could be expected. A pale-yellow edematous area persisted over a period of one to two months. It was distinctly demarcated from the surrounding erythematous area. The color of the edematous area began to change from pale yellow to pinkish red and finally to dark brown when the demarcation between the central edematous area and the surrounding erythematous area became completely obliterated. At the same time, the size of the area also became reduced. At this stage of resolution, the picture resembled a grade 2 lesion. Later on, this dark-brown or dark-red disc began to fade, giving a mottled appearance to the area; or half of the disc might disappear, leaving the retina atrophic. The other half, in sharp contrast to the gray area, appeared intensely red in a few cases. Finally, gray spots and pigmentary stipplings might develop and the central foveal reflex might be completely obliterated (fig. 4).

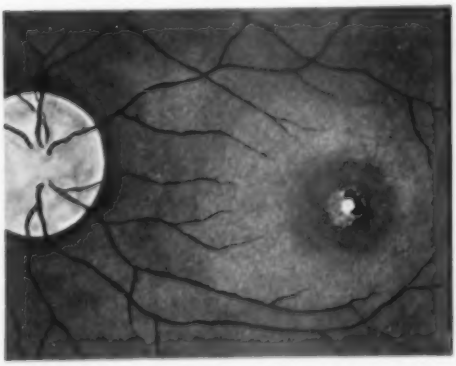

Fig. 3 (Das, Nirankari, and Chaddah). Partial atrophy and intensely red crescentic area.

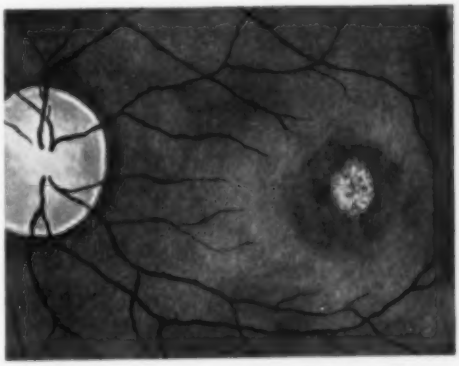

Fig. 4 (Das, Nirankari, and Chaddah). Almost complete macular atrophy.

Discussion

At the present stage of our knowledge of the physiology of color vision and the photochemical processes, it is not possible to explain the diversity of subjective symptoms caused by solar eclipse. One thing, however, is quite clear—that as long as the nervous tissue is alive, it is capable of responding to stimuli, both physiologic and pathologic.

As long as the patient experiences positive scotoma, chromatopsia, and dark spots in front of central field, it is evident that at least a part of the neural tissue is still alive. Hence, the coagulation necrosis of nervous element at the macula is not the immediate concern after eclipse injury, at least not in many cases.

The brunt of injury is borne mainly by the choroid and outer layers of retina as shown in Birch-Hirschfield's experimental studies on rabbits (quoted by Elwyn). The rods and cones are secondarily affected. The choroid shows engorgement of the vessels, which leads to transudation. The fluid readily passes through the damaged pigment epithelium and Bruch's membrane and is absorbed by the loose Henle's fiber layer. The fluid will remain unabsorbed longer at the macular area because of poor vascular supply and the macula will be embarrassed by the presence of the fluid.

The sensitive neural elements can survive on reduced nutrition for a considerable time, as one finds in detachment of retina where good functional results have been achieved even where the retina has been replaced after a long interval of detachment (Wolff, 1951). In the cases of photoretinitis, gross permanent central loss of vision occurs only in extreme cases in which coagulation necrosis has led to permanent damage of the neural tissue; or the lack of nutrition due to an embarrassed blood supply has persisted long enough to lead to atrophy of the macular area.

The severity of ocular damage produced by radiation depends upon the wavelength, the amount of radiant energy absorbed by the tissue, and the location in the eye at which absorption takes place. Most of the ultraviolet rays are absorbed by the cornea and the rest by the lens. The retinal pigment epithelium is relatively transparent to infrared rays, consequently the chief effect on pigment epithelium results from local absorption of visible radiation. The injury is due to an enormous concentration of radiant energy in a very small volume of tissue, producing local heat effect (Friedenwald et al., 1952). Evidently the highest concentration of visible rays (hence energy) can be achieved in emmetropic and hyperopic eyes of slight degree. In such eyes, the optical system is so adjusted as to bring the rays of the sun to accurate focus. The degree of ocular injury also depends on the transmissibility of the lens to the visible rays, which is relatively high in young persons (Duke-Elder, 1954).

Harrington (1946) believes that lesions in the central retinal area are common in patients suffering from autonomic nervous-system dysfunction. In our series of 37 patients, only one patient gave a previous history of headache and distortion of objects which might be due to autonomic nervous-system disorders. She came two months after injury and so we could not observe the earliest changes in her macula. At the time of examination, the visual loss was very marked and the foveal reflex was completely obliterated.

From the observations made in this study we conclude that myopic eyes without properly fitting glasses are least susceptible to phototraumatism, while hypermetropic eyes suffer most.

No theory has yet been offered to explain the cause of the various colored scotomas and chromatopsia. Possibly the nature of exudate which contains toxins in various proportions may offer an explanation. The neural elements may be irritated in different degrees, producing a diversity of subjective symptoms. Another possible explanation is that the toxin-laden exudate acts as a color filter or the edematous area has some prismatic effect.

Summary

1. Thirty-seven cases of macular sun burn are reported.

2. The refraction in these cases revealed that emmetropic or slightly hypermetropic eyes are more easily affected, as the sun's rays are more accurately focused in them.

3. Young persons are more susceptible to injury, since the transmissibility of lens to the sun's ray is highest in them.

4. Coagulation necrosis occurs only in extreme cases. The atrophic changes develop slowly over a period of six weeks to six months. The atrophy is due mainly to vas-

cular embarrassment caused by edema which persists because of the peculiar arrangement of the blood supply of the macular area.

5. Possible explanations of the colored scotomas and chromatopsia are offered.

Department of Ophthalmology.

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Ophthalmic Miniature

That some persons can do with much less light than others is an observation worthy of notice; we are not, therefore, to strain our visual faculties in any case, because we see others can do it. Some instances of this power have been given of an extreme and rather extraordinary kind, particularly by an Italian writer, who records the fact of a person at Pisa being able to see very well in the night, though he was almost blind in the day time; but to this I may add, that cases of the opposite extreme are infinitely more common, particularly with respect to patients suffering under that very extraordinary disorder called "Nyctolopia," by which, though they see extremely well in the day, they become so completely blind on the approach of evening as to be totally incapable of conducting themselves. This complaint is principally, indeed, confined to tropical climates, and evidently proceeds, in a great measure, from relaxation, and partly, perhaps, from exposure to the moon-beams whilst sleeping, a fact particularly noticed by medical men who have had the care of such patients, both in the East and West Indies.

H. Colburn, London, 1816,
The Art of Preserving the Sight Unimpaired to An Extreme Old Age.

NOTES, CASES, INSTRUMENTS

SARCOIDOSIS OF THE ORBIT*

SURVEY OF THE LITERATURE AND REPORT OF A CASE

HAROLD A. STEIN, M.D.,
AND
JOHN W. HENDERSON, M.D.
Rochester, Minnesota

Sarcoidosis is a chronic indolent and benign disease of unknown etiology often involving more than one organ in the body. In fact, almost every organ and system of the body has been reported as being affected by this disease. Because of the relatively few recorded cases of sarcoidosis occurring primarily in the orbit, it was felt worth while to review the literature and present this case.

King,[1] in 1939, presented what he considered to be the first reported case of orbital sarcoidosis. Levitt, in 1941,[2] and Benedict and Wagener, in 1942[3] reviewed the literature on ocular manifestations of sarcoid and did not report any further cases of orbital involvement. Freiman[4] presented an excellent review of the systemic manifestations of sarcoid and also did not mention any further cases of sarcoid of the orbit.

In 1948, Kaplan[5] reported a case of orbital sarcoidosis in which the thorax and bones of the hand subsequently revealed sarcoid lesions. Benedict, in 1949,[6] reviewed the cases of sarcoidosis occurring in the orbit which had been encountered at the Mayo Clinic. In more than 1,000 cases of primary orbital tumors he found and reported only two cases of sarcoid of the orbit which had certain similarities in that they involved the skin of the lids as well as the orbit and were nonencapsulated. In neither case were any systemic manifestations found.

The next year Bodian and Lasky[7] reported a case of orbital sarcoidosis which presented as a movable mass in the left upper lid near the outer canthus. In addition, they found involvement of bones and lungs.

Knapp and Knoll[8] reported a case of primary sarcoidosis of the orbit in a patient with no other evidence of sarcoid. Both this case and that of Kaplan were unusual in that they were precipitated by trauma. Rider and Dodson[9] presented a case of orbital sarcoidosis in a 36-year-old Negro which manifested itself as a painfully protruding blind eye. On enucleation a cartilaginous yellow mass was found in the orbit which was reported as sarcoid. In 1952, Alexander[10] reported a case of orbital sarcoid presenting as gradually increasing proptosis in a 70-year-old man. We wish to add another case to those already reported.

REPORT OF CASE

A 53-year-old white woman entered the Mayo Clinic on June 1, 1955, because the referring physician had palpated a mass in the left orbit five days previously. Six weeks prior to her examination, she stated that the left eyelid began to droop. Her general health was apparently good except for some generalized fatigue over the past six months.

The patient had ptosis, grade 2 (in which grade 1 represents minimal ptosis and grade 4 represents the greatest degree of ptosis) of the left upper lid. Palpebral apertures measured 10 mm. for the right eye and six mm. for the left eye. The vision in the right eye was 20/20, but that in the left eye was reduced to hand movements at a distance of two feet. The left eye was esotropic 10 degrees and had been since childhood. She had been told previously by several oculists that her visual defect had been present since birth. Visual fields were performed and it was concluded that the patient had amblyopia ex anopsia and that her visual deficit was not related to her present complaints.

On palpation, a mass could readily be felt deep to the left in the upper lid, more prominent in the upper temporal quadrant of the left orbit. It extended as a stringy mass from the upper temporal quadrant to the nasal canthus. It could easily be rolled under the fingers and pushed back into the orbit. On examination of the upper fornix the exposed portion of the lacrimal gland appeared normal. On the left side there was minimal limita-

* From the Mayo Foundation and the Section of Ophthalmology, Mayo Clinic and Mayo Foundation. The Mayo Foundation, Rochester, Minnesota, is a part of the Graduate School of the University of Minnesota.

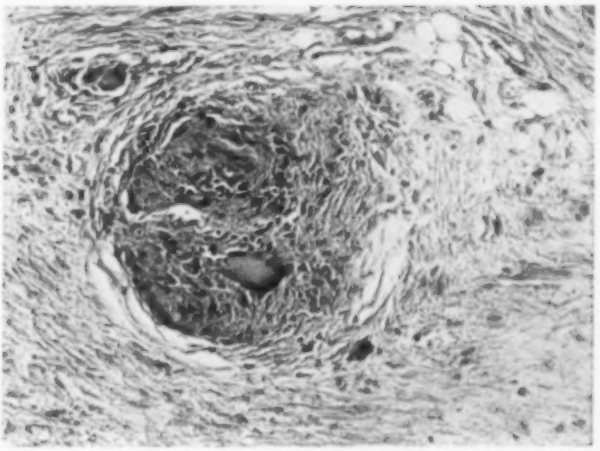

Fig. 1 (Stein and Henderson). Tissue from orbit. Noncaseous granuloma demonstrating giant cells. (Hematoxylin and eosin; ×185.)

tion of rotation of the globe in the field of action of the left superior rectus. Hertel exophthalmometer reading at a base of 92 mm. measured 14.5 for the right eye and 16.5 for the left eye. The left globe was displaced downward; it was not congested or tender. The intraocular pressure was normal. The results of ophthalmoscopic and slitlamp examinations were essentially normal.

The patient was sent for a general examination prior to orbitotomy and the results were essentially negative. Roentgenograms of the thorax, head, orbit, and orbital canal did not show evidence of any abnormality. Laboratory reports revealed that the blood contained 83 percent of the normal amount of hemoglobin; the leukocytes numbered 7,800 per cubic millimeter of blood and serologic tests gave negative results.

Orbitotomy was performed on June 14, 1955, by means of a 50-mm. incision through the upper lid beneath the left brow. A nonencapsulated gristly mass was found and was dissected readily with blunt dissection. It extended from the trochlea across the superior orbit to the lacrimal gland and back deep into the orbit. A portion 20 by 8.0 by 14 mm. was excised. In view of the report on frozen sections, further removal of the orbital mass was not attempted, for fear of damaging orbital structures unnecessarily.

Histologic sections revealed a noncaseating granuloma, such as is seen in Boeck's sarcoid (fig. 1). An acid-fast stain was performed and examination did not reveal the presence of any acid-fast organisms. A periodic-acid Schiff stain of the tissue did not reveal the presence of any fungi.

After the operation, a careful search for other evidence of sarcoid was made. In the course of the examinations roentgenograms were made of the long bones of the extremities and the hands; none showed evidence of any abnormality. The values for protein in the blood serum were as follows: total proteins 6.3 gm., albumin 4.1 gm., and globulin 2.2 gm. The differential count of leukocytes on study of the blood smear was normal. The sedimentation rate was 31 mm. in the first hour (Westergren). The results of tuberculin tests were negative for 0.0001-mg. and 0.005-mg. strengths of purified protein derivative. The low leukocyte count occasionally associated with sarcoid was not present in this case.

The patient received X-ray treatments via an anterior port directly over the globe and a posterior port directly behind the globe. The following technical factors were employed: 130 kv., 8.0 ma., 5-mm. aluminum filter, half-value-layer 0.3 mm. copper, distance 40 cm. Daily treatments were given to each port of 150 r each (as measured in air) for a total of 450 r to each port.

The patient was re-examined three months after treatment. A palpable mass was no longer present, but the ptosis, global displacement, and proptosis seemed about the same.

Comment

Sarcoidosis occurring in the orbit is a rare condition. The infrequency of orbital sarcoidosis was noted by Benedict[6] who reported only two cases in more than 1,000 cases of primary orbital tumors at the Mayo Clinic. Since 1940, more than 200 patients with pathologically proved cases of generalized sarcoidosis have been seen at the clinic.[11] In this 15-year interval, two cases of orbital sarcoidosis have been seen—one reported by Benedict[6] occurring in 1948, and the present case. This condition manifests itself usually as a palpable unilateral mass in the orbit; occasionally it causes proptosis. In the case we have reported, it had produced four mm.

of ptosis as well. The prognosis is usually good, although local recurrences have been reported.

A variety of therapeutic approaches to generalized as well as ocular sarcoidosis have been used. Among them may be listed oral and intravenous administrations of arsenic; treatment with ultraviolet light, radium, and roentgen rays; oral doses of calciferol, corticotropin (ACTH), and cortisone. None of these approaches were employed in any of the previously reported cases. Spontaneous recovery or natural remissions occur so frequently in sarcoid that it becomes very difficult to assess the value of the therapy employed.

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GLAUCOMATOCYCLITIC CRISES OCCURRING IN BOTH EYES*

Paul Levatin, M.D.
Oakland, California

The glaucomatocyclitic syndrome of Posner and Schlossman[1,2] is an odd entity which has the nature of both primary and secondary glaucoma. In appearance it may resemble primary glaucoma but its treatment is that of mild secondary glaucoma. The unilaterality of the syndrome, always affecting the same eye, is one of the points in its differential diagnosis.[3] In this case report of a patient observed frequently for six years, a factor which helped to confuse the diagnosis was the occurrence of the disease in both eyes—although never in both eyes simultaneously.

Case report

J. B., a 42-year-old white machinist, was first seen at the Kaiser Foundation Hospital on April 30, 1948, complaining of pain and redness of the right eye of two days' duration. The first episode of this nature had occurred seven months previously, the day after the extraction of five teeth. There was no family history of glaucoma and his identical twin whom I have examined has never had any eye disease.

The tension in the right eye was 42 mm. Hg (Schiøtz). A diagnosis of acute primary glaucoma was made. The patient was hospitalized and given 50-percent Sorbitol intravenously and drops of one-percent eserine sulfate every two hours. The tension became normal in two days and remained normal until October 10, 1948, when it rose to 41 mm. Hg, with pain in the right eye. Drops of 20-percent Mecholyl and five-percent prostigmin were given without effect. He was rehospitalized and treated as on the previous admission, with normalization of tension in 24 hours. A diagnosis of chronic

* From the Department of Ophthalmology, The Kaiser Foundation Hospital.

noncongestive glaucoma, right eye, was made and the patient was discharged with drops of 0.75-percent Carcholin and 0.25-percent eserine to the right eye every four hours. Eight days later the left eye became "irritated" (tension, 14 mm. Hg) and the following day for the first time the tension in the left eye was elevated to 37 mm. Hg. On one-percent eserine drops, the tension became normal in 24 hours.

He was first seen by me in August, 1949, with a history of discomfort and redness in the right eye for several hours. The right globe was diffusely injected. The anterior chamber contained many discrete particles and some of the iris vessels were dilated. The tension was: O.D., 35 mm. Hg; O.S., 15 mm. Hg. The visual acuity with correction was: O.D., 20/50; O.S., 20/20. The optic discs were not cupped and central and peripheral fields were normal in each eye. The cornea measured 12 mm. in diameter in each eye and gonioscopy revealed an open angle bilaterally. Drops of one-percent eserine controlled the tension but caused much pain.

In February, 1950, an uneventful iridencleisis was done on the right eye and for the next 10 months there were no glaucomatous attacks in this eye. However, in this interval there occurred three episodes of acute glaucoma in the left eye controlled by one-percent eserine drops. Since an iridencleisis had failed to prevent further glaucomatous attacks in the right eye, an Elliot trephining operation was done on the left eye in January, 1951. On the fourth postoperative day, a violent uveitis developed in this eye with fibrinous exudate and blood in the anterior chamber. This cleared completely when 200 mg. of cortisone intramuscularly were given daily.

For the next 14 months there were no further attacks in this eye, although during this interval he was hospitalized once for a severe attack in the right eye. In April, 1952, during a recurrent episode in the right eye, two-plus cells and a one-plus flare were noted in the anterior chamber. The tension in this eye was 35 mm. Hg. It was decided to treat the patient as a case of secondary glaucoma and he was given drops of 10-percent neosynephrine and 0.5-percent cortisone, with intramuscular penicillin. All signs and symptoms subsided within a few hours. The diagnosis of glaucomatocyclitic syndrome was made.

In the next two years six glaucomatous episodes involving either eye cleared within a few hours with a few drops of one-percent neosynephrine and 2.5-percent hydrocortisone. Several incipient attacks characterized by discomfort and redness of either eye were aborted with 2.5-percent hydrocortisone drops alone.

The patient agreed to use no medication during his next attacks. He reported on December 16, 1954, stating that his left eye had become "uncomfortable" eight hours ago followed four hours later with tenderness of the left eyeball and redness of the eye. He maintained that the attacks always started with redness of the eyes ("beginning at one corner or the other"), followed by extreme tenderness of the globe ("soreness of the upper lid"), pain in the eye, and finally blurring of vision.

Examination revealed a few dilated episcleral vessels at the 3- and 9-o'clock positions at the limbus in the left eye with no cells in the anterior chamber. The tension was: O.D., 23 mm. Hg; O.S., 12 mm. Hg (usually 15 to 18 mm. Hg, O.S.). He was advised to use no cortisone drops and by next morning the attack had subsided and the eye was almost white.

He returned on February 1, 1955, and said that his right eye had become red the day before and was now tender. For the previous eight days he had suffered from an upper respiratory infection with rhinitis. Examination revealed deep and superficial bulbar conjunctival injection confined to the upper nasal quadrant of the right globe. There was an occasional cell in the anterior chamber. The tension was: O.D., 12 mm. Hg (usually 20 to 26 mm. Hg in this eye) and O.S., 17 mm. Hg. He was advised to use no eye drops and by next morning the eye

felt fine. There was only a trace of ciliary injection at the 1-o'clock position; the anterior chamber was clear; and the tension in the right eye was 20 mm. Hg.

He returned on May 4, 1955, stating that his right eye had become red the day before and now was very painful. He had suffered from an upper respiratory infection with rhinitis the previous five days. Examination revealed marked deep and superficial injection of the right globe confined to the outer inferior quadrant. There were no cells in the anterior chamber. The tension was 17 mm. Hg, O.U.

Again he used no drops but the right eye ached all night and next morning the entire globe was diffusely injected with one-plus cells in the anterior chamber, a one-plus flare, and mild epithelial edema. The tension was: O.D., 62 mm. Hg; O.S., 17 mm. Hg. This attack was cleared in 36 hours by the use of 2.5-percent hydrocortisone drops every half hour and 10-percent neosynephrine every hour.

Ophthalmologic examination on April 20, 1955, revealed a visual acuity with correction of 20/25−2 in the right eye and 20/20 in the left eye. Both filtration blebs were flat. The iris of the right eye was bound down to the lens by posterior synechias (resulting from the iridencleisis operation) but the left pupil was freely movable. There was no cupping of the discs and the visual fields were full.

No evidence of any serious systemic disease had ever been found in this patient during his many hospitalizations.

Comment

Since the etiology of the glaucomatocyclitic syndrome is unknown, there is no a priori reason why it should not involve both eyes. Perhaps one reason why such a case has not hitherto been recorded is the relative rarity of the disease—occurring in only one out of 25,000 eye patients in my own experience.

The history in this case of the first attack following dental extractions, the fact that an identical twin brother has never had glaucoma, the recurrent episodes of acute glaucoma in the presence of an open angle, the poor response to surgery and to miotics, the prompt response to cortisone, and the occurrence of cells and flare in the anterior chamber in many of the crises—all combine to give the clinical impression that the glaucomatocyclitic syndrome as exhibited by this patient is primarily a mild form of iritis with a disproportionately severe secondary glaucoma; as if in response to an irritant, the uvea reacted with an exudation mainly fluid and only slightly cellular.

Fluid exudation (edema) characterizes the allergic reaction of tissue, and allergy has been suggested as playing a part in this disease by Kraupa[4] and by Theodore.[5] Our patient, however, had no allergies. He was a tense, hard-working, conscientious person with vasomotor instability. There still remains to be explained the cause of the recurrent episodes of uveitis.

It is an established fact that the extraction of teeth is often accompanied by a transient bacteremia. These bacteria may settle on a diseased heart valve and from this focus send emboli to all parts of the body, as occurs in subacute bacterial endocarditis. Although we cannot prove any causal relationship, our patient's illness began the day after the extraction of five teeth. It is interesting to imagine that, as a result of this extraction, there was set up somewhere in the body of our patient a focus of infection from which periodically the uveal tract was stimulated to produce an exudate poor in cells but so rich in fluid that the intraocular pressure was raised.

Otto Lowenstein found the pupillographic responses to be the same in the two eyes in six cases of the glaucomatocyclitic syndrome—a characteristic of unilateral primary glaucoma. From this and other findings, Posner and Schlossman concluded that the disease was most closely related to primary glaucoma and that a central disturbance in the hypothalamus was involved. Von Sallmann[6] sug-

gested that a transient low-grade uveitis from an infective focus might be a better explanation. The history and findings in our case support the latter view.

The ineffectiveness of surgery in controlling the disease has been noted by Kraupa[4] and by Billet.[7]

Summary

A patient with recurrent episodes of glaucoma in either eye (although never in both simultaneously) was thought to have primary glaucoma and was subjected to bilateral filtration operations which failed to stop further episodes. The diagnosis was finally established five years after the first attack and, since then, further glaucomatocyclitic crises have been readily controlled or aborted by medical means.

A trial using no medication revealed that: (1) Two out of three incipient attacks were self-abortive within 24 hours; (2) relative hypotony occurred in the early stage of all the attacks; (3) two of the three attacks began with a sector-shaped area of deep injection of the globe, identical to that seen in episcleritis of allergic origin.

Conclusions

1. The glaucomatocyclitic syndrome may occur in both eyes.

2. In no other form of glaucoma is it more important to remember that ocular hypertension is a symptom not a disease, for, unless the syndrome is recognized and treated properly with cortisone instead of powerful miotics, the patient will eventually be subjected to surgery in a futile attempt to prevent further disabling attacks.

3. The glaucomatocyclitic syndrome as manifested by the patient in this case report is more closely related to secondary than to primary glaucoma.

Broadway and MacArthur Blvd. (11).

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CONGENITAL MICROPHTHALMOS WITH CYST FORMATION*

Jacob Ladenheim, M.D.
Freeport, Illinois
and
Seymour Metrick, M.D.
Chicago, Illinois

Congenital microphthalmos with cyst formation is an uncommon condition which should be differentiated from anophthalmos,[1] meningocele, and encephalocele. Cyst formation may result where a large knuckle of retina protrudes into the surrounding tissue in the region of the fetal cleft, forming a cystic protrusion of a dimension greater than the eye itself. Baurmann[2] postulates the essential cause of such a protrusion to be an active proliferation of the ectodermal elements at the lip of the fissure, although in many of them a passive ectasia may play some part.

* From The Department of Ophthalmology, Cook County Hospital, Chicago.

Clinical findings

Although there is said to be considerable variation, two main groups are defined. In

the first group, a well-formed eye is visible but may be unusually small and grossly abnormal. In the second category are those cases in which no eye is discernible, the globe having been pushed out of sight by a cyst of varying size. The clinical picture here is one of anophthalmos but it may be distinguished from anophthalmos in several ways:

1. A small mass may be palpated in the posterior wall of the cyst.

2. Transillumination may reveal a small dark shadow which is a remnant of a rudimentary eye.

3. The presence of a patent optic foramen demonstrated roentgenographically is presumptive evidence of a microphthalmic eye. In a true anophthalmos, the optic nerve is almost invariably absent and the optic foramen is either narrow or obliterated.

Etiology and Pathology

Many pathologic investigations have supported Arlt's[3] hypothesis that the cyst is associated with a defective closure of the fetal cleft.

The outer lining of the cyst is usually continuous with the sclera. The choroid may extend a little way into the cyst but is usually absent over the greater part of the wall. The inner lining is formed by representatives of the various derivatives of the optic vesicles and in the majority of cases elements of both layers are distinguishable.

The pigment epithelium lining the outside may appear relatively normal but is frequently unpigmented, and sometimes appears as a laminated layer of cellular tissue with occasional patches of retinal elements in it.

The retina is usually matted together and altered so that recognition is difficult. Considerable amount of glial hyperplasia is not uncommon. Rods and cones are rarely developed and sometimes the rudimentary retinal layers are arranged in their normal orientation, while at other times they are inverted.

The cyst is usually filled with a clear, yellow, alkaline fluid of a high protein content (Duke-Elder[4]).

Case report

Baby M. was born on October 5, 1954, following a normal spontaneous delivery. Birth weight was six pounds and eight ounces. There was no history of maternal illness during the pregnancy except for a mild upper respiratory infection during the second month. The mother was attended by a physician at this time. No history of German measles could be elicited.

Both parents are Rh+ and serologies are reported as negative. There is no history of congenital anomalies in the family. There are two sisters, aged 19 and nine years, and one brother six years of age. Siblings are all normal.

Physical examination. The patient was first seen on October 14, 1954. The entire physical examination was noncontributory

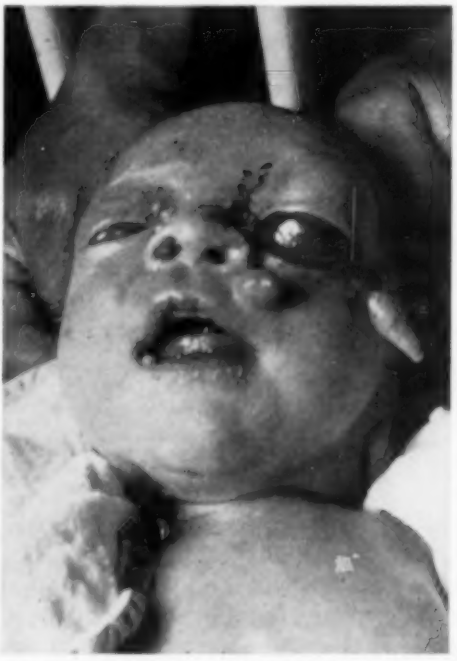

Fig. 1 (Ladenheim and Metrick). Patient at one week of age.

except for the obvious facial deformities (figs. 1 and 2).

The eyelids were normal and held open by large cystic masses which replace the globe. The cystic masses were four to five cm. in diameter. The outer surface had the appearance and texture of conjunctival tissue. At the time of the initial examination, no globe could be palpated in the orbit and none was revealed by transillumination.

There was a nonpedunculated cylindric skin appendage below and to the left of the nose about one-half cm. long and of equal width. In the left malar region there was an appendage two-cm. long covered with normal skin. There was a minute appendage at the right commissure labialis. There was a one-cm. defect in the skin over the pinna of the left ear with exposure of the underlying muscle tissue. A small dermal sinus was present anterior to the left ear and pinpoint in size. A small amount of white mucoid material was expressed. On several occasions, turbid yellow fluid was aspirated from the cysts for chemical analysis (table 1) and on each occasion the cyst refilled within 24 hours. When the cyst was collapsed, a small but firm mass about one cm. in diameter could be palpated at the back of the orbit.

On one occasion, methylene-blue dye was injected into the mass but no trace of it could be detected in the spinal fluid. X-ray films of the chest were reported as negative.

X-ray findings. October 28, 1954: "Four views of the skull reveal a round soft tissue mass protruding from the left eye. The fontanelles are open and the sutures are widened. The etiology of the protruding mass cannot be determined."

May 16, 1955: "Anteroposterior and lat-

TABLE 1

ANALYSIS OF CYST FLUID

	10-27-54	5-17-55	Normal Spinal Fluid
Glucose	50	60	50– 70 mg./100 cc.
Protein	82	40	20– 50 mg./100 cc.
Chloride	113	116	115–130 mg./100 cc.

Fig. 2 (Ladenheim and Metrick). Patient at one week of age.

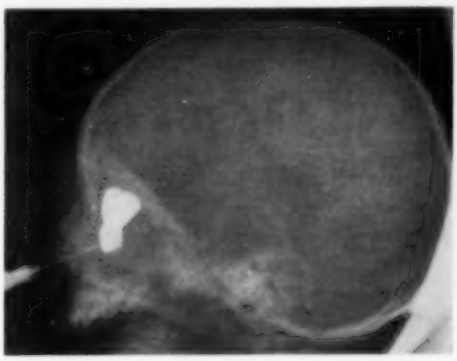

Fig. 3 (Ladenheim and Metrick). Right lateral X-ray view at time of injection of radiopaque dye. Note soft tissue shadow.

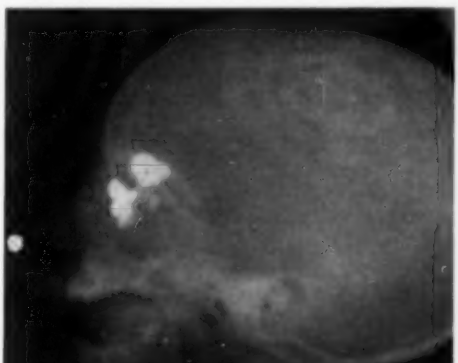

Fig. 4 (Ladenheim and Metrick). Right lateral X-ray view five minutes after injection of radiopaque dye.

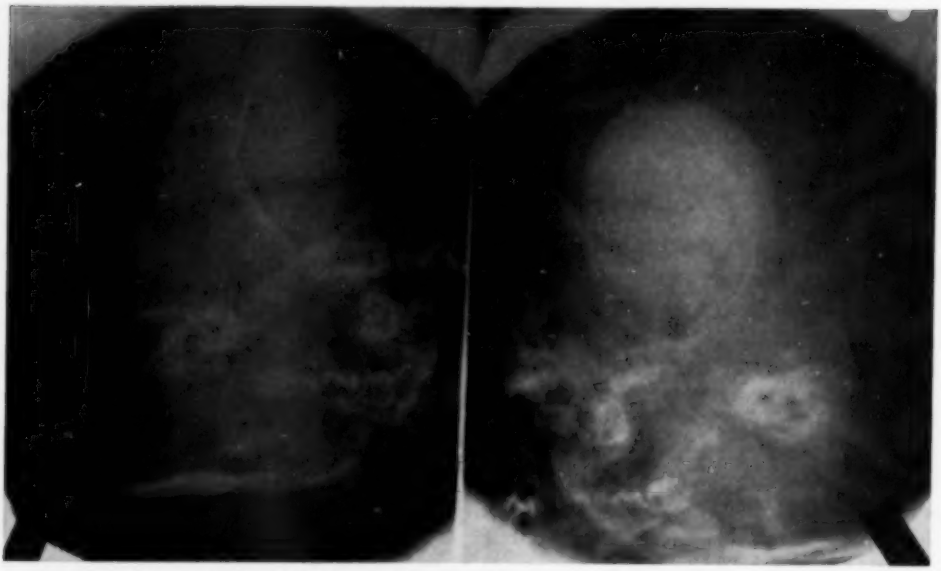

Fig. 5 (Ladenheim and Metrick). X-ray view of orbit, showing patency of optic foramen bilaterally.

eral views of the skull show rounded soft tissue densities in the projection of the orbit. Other evidence of osseous or intracranial pathology is not seen."

On May 27, 1955, two cc. of Pantopaque were injected into the mass and films were taken on injection (fig. 3) and at one, two, and at five (fig. 4) minutes. The report was as follows:

"Oblique views of both orbits and lateral view of the skull show rounded increased soft tissue densities superimposed on both orbits, more pronounced on the left. Right lateral views following injection of radiopaque material into the cystic mass overlying the right orbit reveals no communication with the cerebrospinal system. Numerous pockets within the cystic mass are demonstrated in the superior portion, apparently causing some pressure erosion on the superior wall of the orbit.

"Impression: Cystic masses protruding from each orbit."

X-rays studies also revealed patency of each optic foramen (fig. 5).

Findings. Large fluid-filled cystic masses protruded from each orbit with a palpable mass in the posterior portion of the orbit. The optic foramina were patent. There was no demonstrable communication with the cerebrospinal system. The diagnosis was congenital microphthalmos with cyst formation, bilateral.

On September 10, 1955, the baby was reported in good condition, though somewhat retarded mentally.

222 West Exchange.

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METHOD FOR ANCHORING POLYETHYLENE TUBES AND RE-ESTABLISHING TEAR DRAINAGE*

GILBERT A. REESE, M.D.
Sacramento, California

Since their introduction, polyethylene tubes have been experimentally used in re-establishing tear drainage in the lacrimal system. One of the principal problems, once the tube has been introduced, is proper anchoring.

Several methods have been suggested, such as flaring the end of the tube as it emerges at the punctum.[1] Various ways of anchoring the tube with suture material have also been reported.[2-4]

It has been found very difficult to pass suture material through the wall of the polyethylene tubes without entering the lumen, particularly the small tubes which have been found the most pliable and easiest to handle after they are introduced into the lacrimal system. As it is necessary for a tube to have several angular turns when in place in the nasolacrimal system, the larger polyethylene tubes will often produce pressure necrosis of tissue due to their lack of pliability.

The size of polyethylene tube which has been found the most desirable for this procedure has an inner diameter of 0.58 mm. and an outer diameter of 0.965 mm. In this size tube it was impossible to pass even a Grieshaber C-7 corneal needle under a microscope into the wall without creating a fistula. On irrigation of the tube with a fistula a portion of the fluid is, of course, flushed into the tissue, providing a continual source of infection. All too often, in spite of flaring the end of the tube at the punctum, it will slip through, particularly in a canaliculus that has had a great deal of instrumentation and has been dilated; or when the canaliculus has been slit.[5]

The method to be presented involves no variation in the introduction of the polyethylene tube other than it must be approximately 50 centimenters long. A plastic tubing, thin-walled needle with the stylet in place is introduced through the punctum, canaliculus, and through the anterior lacrimal crest following a dacryocystectomy. Once the distal end of the needle is in the middle meatus of the nose a 50-cm. length of polyethylene tube is passed through the needle. The needle is removed from the lacrimal system, leaving the tube in place so that it can be threaded through the nose with ease.

The long lateral end of the polyethylene tube is left emerging from the punctum so that approximately 40 cm. are available for the manipulation to follow. A 10-cm. length of surgical stainless-steel wire (gauge 32) is then passed into the long lateral end of the polyethylene tube. The steel wire is cut flush with the end of the tube. The tube with the wire enclosed is then molded in the fornix of the lower lid by making a sharp right-angle turn at the punctum down and medially. Another sharp turn in the tube is then made so that the tube lies in the cul-de-sac of the lower fornix.

When the tube has been fashioned to fit properly into the cul-de-sac without deforming the lid or pressing on the globe it is removed through the punctum laterally, keeping the same form with its several angular turns. When approximately 40 cm. are available for manipulation on the lateral end, it is dipped in recently boiled water for 10 to 14 seconds to fix it in its angulated form and then allowed to cool for 30 seconds. Care must be taken not to lose the short medial end emerging from the nose.

The pliable steel wire is then removed and the polyethylene tube remains molded in its angular position. The tube is re-threaded back through the nose so that the several sharp turns in the tube prevent it from slipping out of place.

After a proper fitting, it is very difficult

* From the United States Public Health Service Hospital, Galveston, Texas.

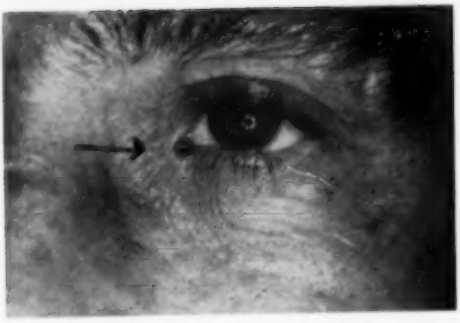

Fig. 1 (Reese). Preoperative. A fistula from both the upper and lower canaliculi results in tear drainage over the face.

to tell that the tube is in place; it can be found only after close examination. It is advisable not to cut the long medial end emerging from the nose for seven to 10 days for, if the first fitting is not satisfactory, with adequate tubing available the procedure can be repeated in the office at a later visit. When the surgeon is sure that a satisfactory fitting has been made, the tubing can be cut as it emerges from the nose.

The tube should always be irrigated from the nasal end, using a smooth-tip forceps and a dull needle or a lacrimal needle. There is a tendency in the first few weeks for mucus to plug the tube in the lower fornix. This gradually decreases in amount the longer the tube remains in place.

Even when the tube becomes plugged, the patient continues to have tear drainage. Undoubtedly adequate drainage of tears occurs around the tube as well as through it. Henderson[6] has had a similar experience, and even doubts the need for irrigating the tubes once they are in place. The formation of a permanent epithelized tract for tear drainage is more certain the longer the tube remains in place. It would seem that a tube anchored by the method herein described could be left in place indefinitely if desired.

Case report

Case P. D.

The patient entered the hospital on October 20, 1954, with the chief complaint of tearing from the right eye. In 1949, the patient was kicked in the right side of the face and approximately two months later he was hit with a beer bottle, suffering lacerations of the right upper and lower canaliculus. This was sutured together but, since that time, he has had tearing over the right side of his face.

The past history revealed the patient had a broken zygoma in 1953 and a submucous resection in the nose in 1953.

Physical examination was essentially negative except for the eye. There was an obstruction of the right upper and lower canaliculus, five mm. from the punctum. There was a fistula emerging through the skin from the upper and lower canaliculus so that, when the irrigating needle was placed in the punctum, the fluid emerged through the fistula. The fistula was present

Fig. 2 (Reese). The polyethylene tubing in place in the nasolacrimal system. Wire in the lateral tube emerges from the punctum in preparation for the molding procedure in the lower fornix.

in approximately the area of laceration suffered five years ago.

On October 22, 1954, a window was created in the anterior lacrimal crest and the polyethylene tube was passed into the nose by this route. The tube was anchored to the medial palpebral ligament with 6-0 silk. Postoperatively the patient did well and the tube irrigated freely. However, only 18 days later it slipped from position and moved up and down. Three weeks postoperatively, the patient came in with an acute cellulitis on the medial side of the right orbit with the tube extruding through the center of an abscess. The tube was removed and the patient treated with antibiotics until the infection cleared.

He was readmitted on April 6, 1955. He was placed on antibiotics and a second operation was performed. A long, 50 cm., polyethylene tube, inner diameter 0.58 mm. and outer diameter 0.965 mm., was left in place. The lacrimal sac was dissected out and removed. The two sinus openings on the skin from the canaliculus were cauterized. The patient remained on antibiotics three weeks following the operation and there was no postoperative infection.

Two weeks postoperatively, the lateral long end of the polyethylene tube, emerging from the punctum, was threaded with gauge-32 surgical stainless steel wire. The tube with the steel wire in place was threaded through the nose until the tube, containing the surgical wire, was in place at the lower lid. Under pontocaine anesthesia it was introduced into the fornix of the lower lid and molded to fit snugly between the globe and lid.

The tube was then removed laterally through the punctum, maintaining its angular form so that there was plenty of available tubing to manipulate the lateral molded portion into recently boiled water. After the tube had cooled, the pliable steel wire was removed, leaving the tubing in its previously molded angular shape. The polyethylene tube was then rethreaded through the nose so that the lateral end emerging from the punctum could be placed into the fornix of the right lower lid.

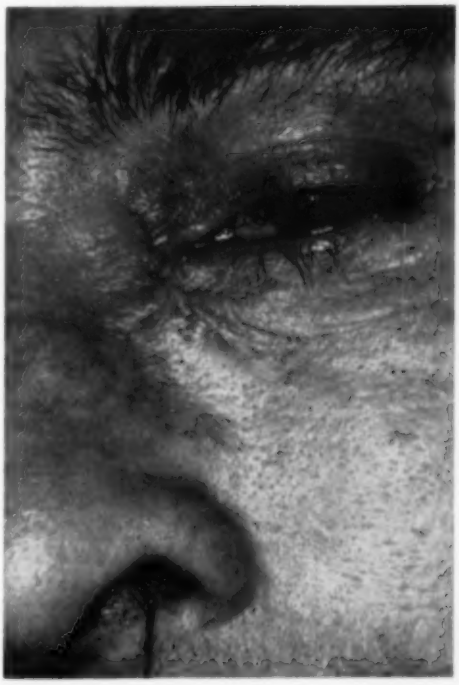

Fig. 3 (Reese). Postoperative. After proper fitting, the tube usually is not seen in the eye. The marker is directed toward the cut tube in the nose.

There was a tendency in the first few weeks for the right eye to form a white tenacious mucous secretion. This gradually subsided, however, and plugging the tube was not a serious problem. Three weeks postoperatively, the tube could easily be irrigated from the nasal end, which was cut off just inside the nostril.

Summary

1. A new method of fashioning polyethylene tubes to provide secure anchorage after introduction into the nasolacrimal system has been presented.

2. Steel wire is introduced into a 50-cm. length of polyethylene tube that is in place in the nasolacrimal system. Several angular turns are made in the tube so that it fits

snugly in the lower fornix between the globe and lower lid. The lateral angulated portion of the tube is removed from the lower lid and dipped in hot water to fix it in position, then the pliable steel wire is removed. The plastic tubing maintains its angulated form so that it fits securely in the fornix of the lower lid when rethreaded through the nose.

3. Tear drainage appears to occur around the tube as well as through it.

4. The polyethylene tube can be left in place for an indefinite period of time without any disfiguration.

2901 Capitol Avenue (16).

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Ophthalmic Miniature

I merely intend to draw attention to the examination of the field of vision, an examination which has not, in my opinion, been used for diagnostic purposes with the enthusiasm and exactness it rightly deserves. . . . In determining central visual acuity, we are only partially informed concerning the patient's faculty of vision. The second and equally important part is the determination of the dimension and modality of eccentric vision. . . . A number of pathologic conditions are manifest for a time only by the changes in eccentric vision and it is only the last stage which induces progressive dimness of central vision.

Albrecht von Graefe,
Untersuchung des Gesichtfeld bei amblyopischen Affectionen,
Arch. f. Ophth., **2**:258 (Pt. 2) 1856.

OPHTHALMIC RESEARCH

Department

EDITED BY FRANK W. NEWELL, M.D.

Abstracts of papers presented before the Midwestern Section of the Association for Research in Ophthalmology, March 17, 1956, at the Northwestern University Medical School, Chicago, Illinois

THEODORE F. SCHLAEGEL, JR., M.D., *Section Secretary*

The effect of hallucinogenic drugs on the electroretinogram. Julia T. Apter, M.D., Neurophysiology Laboratory, Manteno State Hospital, Manteno, Illinois.

LSD-25 and mescaline are hallucinogenic drugs which appear, to some workers, to induce a psychosis similar to schizophrenia. Some aspects of the induced visual hallucinations, however, indicate that they may be ocular in origin and therefore are not similar to psychotic hallucinations. This hypothesis was tested by the electroretinogram in cats and in man. The studies demonstrated that spontaneous action potentials appear in the eyes of dark-adapted cats after intraperitoneal injections of LSD-25 or mescaline but not nonhallucinogenic drugs. In humans, action potentials in the electroretinogram are simultaneous with the drug-induced hallucinations. These drugs potentiate the activity of the retina so that its threshold is lowered and summation of activity markedly increased. The hallucinations, therefore, probably arise because the subject sees his own intraocular structures ordinarily not perceived and because he has a greatly amplified retinal response to any extraocular stimulus.

Studies on the autonomic innervation of the iris. Julia T. Apter, M.D., Neurophysiology Laboratory, Manteno State Hospital, Manteno, Illinois.

The functions of the parasympathetic and sympathetic innervation of the iris were investigated by means of action potentials. The potentials induced by physiologically evoked changes in the size of the pupil as well as by electrical stimulation of sensory nerves were recorded. Results indicate that the sympathetic innervation of the iris of cats shows no activity simultaneous with any dilation of the pupil except that concurrent with awakening. The parasympathetic ganglion on the other hand shows activity with dilation as well as with constriction. A review of other studies on this subject in the light of the present work indicates that the sympathetic nerves to the iris and sympathomimetic drugs change the size of the pupil primarily by changing the caliber of iridal blood vessels. The parasympathetic nerves change the size of the pupil by action and inhibition to the constrictor muscle. The so-called dilator muscle acts passively to allow maximal dilation and to prevent maximal constriction as a result of slow tonic impulses supplied by the sympathetic nerves.

The effects of hypoxia and hyperoxia upon the oxygen tension in the vitreous humor of the cat. Seymour B. Goren, B.A., and Arlington C. Krause, M.D. Section of Ophthalmology, The University of Chicago. (Supported by the Douglas Smith Foundation for Medical Research and the Chicago Community Trust of Chicago.)

The purpose of this study was to de-

termine the relationships between the oxygen tension in the vitreous humor of the adult cat and the environmental conditions of hypoxia and hyperoxia. The polarograph method was utilized for measuring the oxygen tension in the vitreous humor under varying environmental conditions. This technique employs the use of a platinum electrode which is capable of reducing the oxygen in the tissue being studied, thereby creating a current which can be measured with a galvanometer.

Under normal physiologic conditions, the oxygen tension in the vitreous humor of the adult cat was 53 mm. Hg. When the animal was submitted to moderate hypoxia, such as 114 mm. Hg of oxygen in the inspired air, the oxygen tension in the vitreous humor was 28 mm. Hg. This decrease is to be expected since the blood hemoglobin holds less than the normal amount of oxygen when the oxygen tension in the environmental atmosphere is low. Therefore, less oxygen is available to the body tissues, thereby causing a decreased oxygen tension in the vitreous humor.

When the animal was placed under conditions of increasing degrees of hyperoxia, a corresponding exponential increase in the oxygen tension in the vitreous humor resulted until a maximum of 175 mm. Hg was reached. This value was attained when the oxygen tension in the inspired air was 609 mm. Hg. It is of interest to note that the blood hemoglobin is fully saturated with oxygen at values far below 609 mm. Hg. The increased oxygen which goes into simple solution in the blood plasma is not sufficient to explain the difference in oxygen tensions in the vitreous humor found under moderate and severe hyperoxia. For some unknown reason, a greater quantity of oxygen diffuses into the vitreous humor when the animal is under severe hyperoxia than is the case under moderate hyperoxia, although basically the same amount of oxygen is being carried through the blood vessels of the eye in both conditions. Further research is necessary before this fact can be adequately explained.

It was also found that the oxygen tension in the vitreous humor of a cat, when it was removed from hyperoxic conditions of 455 mm. Hg of oxygen and placed under normal physiologic conditions, decreased exponentially. This finding is in agreement with the sharp initial decrease and the subsequent leveling off of the blood hemoglobin saturation with oxygen when an animal is transferred from an atmosphere having a high oxygen tension to one having a normal oxygen tension.

Disuse and retrograde degeneration of retinal ganglion cells. Kao Liang Chow, Department of Physiology, The University of Chicago.

The retinas of two chimpanzees, one reared in darkness from birth to 33 months of age, and the other kept in darkness from eight to 24 months of age, showed complete degeneration of the ganglion-cell layer. This pathologic condition did not involve either the receptive or the bipolar layers. A third animal, which was reared in the dark from birth to seven months of age, but with one and one-half hour diffuse light stimulation daily, had a normal retina.

In the cat's retina, the ganglion cells send axons to the lateral geniculate body and collaterals to the superior colliculus. By selective destruction of either one of these two nuclei, it is possible to study the resultant retrograde degeneration, caused by the damage of the axon or of the collateral, by itself. Preliminary results indicate that the effect of destroying the lateral geniculate body is similar to that of cutting the optic tract caudal to the chiasm. In either case there is a general decrease of the ganglion cells ipsi-

lateral to the lesion. The giant ganglion cells, however, remain normal. Lesions in the superior colliculus only have very little effect on the retinal ganglion cells.

The first study was conducted with the co-operation of A. H. Riesen and F. W. Newell; the second study with I. T. Diamond and W. D. Neff.

On the mechanism of oxygen poisoning. E. S. Guzman Barron, Department of Medicine, The University of Chicago.

The development of retinopathies in newborn babies kept at oxygen pressures above those found in the atmosphere has stimulated research on the possibility that oxygen at one atmosphere pressure might be toxic. We have found that sulfhydryl compounds like glutathione and co-enzyme A, as well as sulfhydryl enzymes like alcohol dehydrogenase, are more sensitive to the action of high oxygen pressures than other oxidation reduction systems and other enzymes. Pyruvic acid oxidase is inhibited by oxygen at a tension of one atmosphere, and other SH-enzymes are also inhibited in a similar manner. The retina has a high aerobic metabolism, and during the process of vision, the vitamin aldehyde reductase must be very active. On exposure to oxygen at atmospheric pressures, it is quite possible that the aerobic metabolism is inhibited and the vitamin aldehyde reductase is destroyed by oxygen.

Experimental toxoplasmosis in the rabbit: I. Natural course after intraocular injection. Neva P. Arribas, M.D., and T. F. Schlaegel, Jr., M.D. (with the technical assistance of A. Irene Baird, B.S.), Department of Ophthalmology, Indiana University School of Medicine. (Supported by a research grant, B-539 (C), from the National Institute of Neurological diseases and Blindness of the National Institutes of Health, Public Health Service.)

Doses ranging from 200 to 50,000 of the Rh strain of Toxoplasma gondii in 0.05 ml. nutrient broth were inoculated into the anterior chamber, vitreous cavity, and suprachoroidal space of the eyes of adult pigmented rabbits. Severe anterior uveitis with extension to the posterior uvea was observed following anterior chamber injection. Intravitreal inoculation was followed with the formation of extensive exudative chorioretinitis which was initially discrete but rapidly formed large maplike patches. Suprachoroidal inoculation was characterized initially by local retinal edema, and then by generalized spasm of arterioles and venules, generalized fundus haze, and subrentinal fluid which led to moderately extensive retinal detachments. Small and discrete soft exudates were seen in the later stages and involvement of the anterior uvea depended upon the severity and duration of the disease. Rabbits developed signs of systemic infection starting on the third to the fifth day, depending upon the dose of the inoculum. Death usually occurred within two weeks.

On microscopic study it was found that the anterior chamber injection led to an iridocyclitis followed by minimal involvement of the posterior uvea in the later stages. The anterior chamber was filled with transudate and an admixture of inflammatory cells. The cornea was edematous with interlamellar infiltrates and lymphocytes and polymorphonuclears on the endothelial surface. The iris was diffusely thickened with enormous congestion, edema, and chronic inflammatory cells, with clumps of cells enmeshed in fibrin on the anterior surface. Synechia were extensive. Suprachoroidal inoculation led to choroidal congestion with subrentinal fluid in the early stages and massive necrosis and thickening of the choroid and retina in the late and severe cases. There was loss of normal tissue pattern, dispersion of pigment and ne-

crotic debris, and chronic inflammatory cells. The sclera was often involved and early extension to the ciliary body and iris was present in the late and severe cases. Intravitreal injection was followed with a minimal transudate in the vitreous cavity with some polymorphonuclears the first few days; then with patchy localized retinal necrosis with focal edema and distortion of the inner retinal layer; and in the later stages by a picture of extensive involvement of the retina and choroid with necrosis, thickening, chronic inflammatory cells, and dispersion of pigment and necrotic debris.

Some observations on the relationship of electroencephalographic changes to neuro-ocular disease. Philip T. White, M.D., and T. F. Schlaegel, Jr., M.D., Departments of Neurology and Ophthalmology, Indiana University School of Medicine, Indianapolis, Indiana. (Supported by a research grant, B-87, from the National Institute of Neurological Diseases and Blindness of the National Institutes of Health, Public Health Service.)

A number of investigators have indicated that the electroencephalogram gives some clue as to the nature of the underlying disorder in ambloyopia ex anopsia. It appears, however, that certain erroneous conclusions have been drawn and that there has been a lack of familiarity with normal recordings in children. One should look with skepticism upon articles using changes in the electroencephalogram to place the seat of disorder of amblyopia ex anopsia in the cerebral hemispheres.

A series of six children from 10 to 16 years of age with amblyopia ex anopsia were compared to a series of six children from 11 to 16 years of age with hysterical amblyopia. Each of these children was subjected to photic stimulation with the eyes opened, with the eyes closed, with the eyes stimulated independently, and with the eyes stimulated together in different visual fields. Insofar as possible, each of the subjects was subjected to a complete neurologic history and physical examination and all subjects even remotely suspected of some intrinsic neurologic disease were eliminated from the study.

There were no differences between the two groups and the only significant change in the driving response was that its amplitude was directly proportional to the intensity of the stimulus.

Selective perception in hysterical amblyopia. N. Kent and T. F. Schaegel, Jr., M.D., Department of Ophthalmology, Indiana University School of Medicine. (Supported by a research grant, B-251 (R), from the National Institute of Neurological Diseases and Blindness of the National Institutes of Health, Public Health Service.)

In order to compare the selective perception of persons with hysterical amblyopia with normal subjects five classes of words were presented: sexual, scoptophilic, visual symptom, nonvisual symptom, and neutral, all of which appear with equal language frequency, by means of a tachistoscope, a device for controling the duration of a visual stimulus. Interest was directed toward determining if these patients had different visual thresholds for the words than normals, if they differentially responded to the classes of words autonomically before they were able to verbalize them, and whether this response differed from the autonomic response elicited by the words when they were presented sufficiently long for the subjects to recognize them.

Nine persons who were diagnosed as having hysterical amblyopia were compared with seven persons who had no history of ocular difficulties and whose vision was normal, and seven persons

whose vision had to be corrected by eyeglasses. The words were presented to all subjects tachistoscopically, beginning at intervals so short that the subjects could not recognize them. These intervals were increased in discrete steps until the subjects were able to verbalize the word correctly. This defines the visual threshold. Concurrent with these operations the galvanic skin response of the subjects was being continuously recorded for use as the autonomic response measure.

Analysis of the data indicated that there were several differences between the responses of the patients and the control groups: These tended to indicate that

1. The words had to be presented for longer intervals for the patients to recognize them than for the controls.

2. There was a differential autonomic response to the words before they were recognized than when they were recognized in the following manner: The patients' autonomic responses were largest to sexual words before recognition and to symptom words after recognition. On the other hand, the control groups responded to the sexual words maximally after recognition.

3. There were no apparent differences between the two control groups.

Ocular lesions produced by sodium iodoacetate. P. A. Cibis, M.D., M. Constant, Ph.D., and A. Pribyl, Washington University, Saint Louis, Missouri.

The intravenous administration of iodoacetic acid (IAA) in doses varying from 20 to 60 mg./kg. produced lenticular changes in rabbits which closely resembled those observed in radiation cataract. It caused exudation into the anterior chamber after two days and into the vitreous body after four days; it depressed the mitotic activity for more than 12 days and produced vacuolization at the posterior pole and the postequatorial area of the lens cortex within two to four months. Swelling of the lens fibers and opacification developed at later stages. The histologic changes consisted of lens capsule and fiber swelling, proliferation and displacement of epithelial cells posteriorward, formation of balloon cells, and liquefaction of the cortex. In advanced cases the picture of hypermature cataract developed.

Beta-hypophamine (Vasopressin): Its effect upon intraocular pressure and aqueous flow in normal and glaucomatous eyes. Bernard Becker, M.D., and Robert E. Christensen, M.D., Washington University, Saint Louis, Missouri.

The antidiuretic hormone, beta-hypophamine, lowers intraocular pressure when applied topically to normal and glaucomatous human eyes. Repeated tonography reveals that the fall in intraocular pressure results from an average supression of aqueous flow of 60 ± 5.0 percent in normal eyes and 59 ± 7.0 percent in untreated glaucomatous eyes. Glaucomatous eyes receiving miotic therapy appear to respond less dramatically to Vasopressin administration (39 ± 12 percent supression of flow); and those eyes subjected to miotic and acetazoleamide therapy demonstrate even less (24 ± 10 percent) decrease of aqueous flow. The clinical usefulness of Vasopressin appears to be limited to short term application because of the rapid development of a resistant state of the eye to the pressure-lowering effects of the drug.

Experimental tonography: II. The effect of various compounds on the intraocular pressure of the rabbit. Marguerite A. Constant, Ph.D., and Bernard Becker, M.D., Washington University, Saint Louis, Missouri.

The effect of three compounds (Thora-

zine, Regitine, and Pitressin) which were found to cause a decrease in intraocular pressure by tonometric measurements were further studied by the tonographic procedure. A reduction in aqueous flow was observed following the administration of each of these compounds to rabbits. Thorazine (0.5 mg./kg.) reduced aqueous flow approximately 73 percent; Regitine (0.3 mg., topical), 73 percent; and Pitressin (2.0 units, topical), 83 percent. Decreases in intraocular pressure and in the facility of outflow were observed. Lower doses of Regitine (0.1 to 0.2 mg.) resulted in somewhat less suppression of flow (53 percent). Intraocular pressure was decreased at these dosages, but no significant change in outflow facility was observed. Lower doses of Pitressin were variably effective in decreasing pressure and outflow facility with the treated eye generally being more responsive than the contralateral eye. The Regitine data confirm the reports of other investigators on an influence of the sympathetic nervous system in the regulation of aqueous flow. When aqueous flow was suppressed somewhat more than 50 percent, a compensatory decrease in outflow facility occurred.

Histologic changes in radiation cataracts in mice. R. D. Richards, M.D., T. C. Evans, Ph.D., E. Riley, Ph.D., Department of Ophthalmology, College of Medicine, State University of Iowa, Iowa City, Iowa.

Approximately 500 mouse lenses were examined histologically after exposure to either neutron or X radiation. The X radiation characteristics were: 200 kv., filtered with 0.25 mm. Cu and 1. mm. Al. Dosages up to 1,000 r, head only, were used. The neutron radiation was produced by deuteron bombardment of a beryllium target in a 37 inch cyclotron. Dosages ranged up to 250 rep (roentgen equivalent physical) which was cataractogenically equivalent to a single exposure of about 1,200 r of X radiation. The mice were a Swiss albino strain, both male and female, and were irradiated at between 2.5 to 3.5 months of age. Lenses were preserved in Carnoy's solution at various times after exposure; tissues were embedded in paraffin and sections were stained with hematoxylin-eosin.

Histologic comparison of cataracts produced by neutron and X radiations showed no qualitative difference. The extent of change was dose dependent; the pattern of change was the same with biologically equivalent exposures.

We find, in agreement with others, that the earliest change noted is a distortion of the lens-bow pattern due to swollen fibers and vacuoles. The abnormal cells spread from the equatorial zone posteriorly and anteriorly immediately beneath the capsule. Later, abnormal (and still nucleated) cells accumulate under the capsule posteriorly. These resemble epithelial cells and are termed "pseudoepithelium."

Groups of cells with persisting nuclei frequently formed plaques at either one or both poles. Next, vacuoles and swollen fibers with granular cytoplasm are seen in the entire subcapsular region. These large, swollen fibers are seen at times to coalesce, forming a sharply outlined vacuolar area filled with granular material. Cortical thinning at the polar regions is apparent in later stages. The older fibers (formed before the irradiation) around the embryonic nucleus remain normal. In the final stages, there may be complete degeneration of the entire cortex. Markedly swollen fibers, large vacuoles, subcapsular "pseudoepethelial" cells, polar cortical thinning, and polar subcapsular plaques are present. Eventually, only the embryonic nucleus may remain intact.

It appears that radiation production of a complete cataract in mice involves pri-

marly two stages (1) an earlier one of isolated cellular damage and (2) a later one of overwhelming release of autolytic processes involving practically all structures of the lens.

Familial occurrence of developmental anomalies of cornea, iris, and chamber angle: With visible region of Schlemm's canal. M. Hobson Rice, M.D., State University of Iowa, Iowa City, Iowa.

A family of 10 all of whose members show some features of the complex picture of "mesodermal dysgenesis of the cornea and iris" is presented. Abnormalities include persistent adherence of iris to cornea, corectopia, embryotoxon posterius, hypoplasia of the iris, and megalocornea. The ocular tension was normal in the nine members tested.

Two members of the family are unique in that they have what has been interpreted to be an externally visible region of the canal of Schlemm due to pigment deposited in this region. It is felt that this finding gives a basis for future identification of such pigmentation and its location, and should be an aid in the correlation of the findings on external examination of the limbus to the true anatomy of the chamber angle.

Skin sensitivity in experimental Candida albicans infections of the cornea and conjunctiva: A Preliminary report. Camil S. Matta, M.D., Department of Ophthalmology, State University of Iowa, Iowa City, Iowa.

This work was an attempt to find whether Candida albicans infections of the cornea and conjunctiva cause a general sensitivity which can be detected by a skin test.

Preparation of a specific extract that would constantly show only this sensitivity had to be found before starting eye infections. Five extracts of acetone-killed Candida albicans were prepared: Alkali-soluble fraction, acid-soluble fraction, ether-soluble fraction, 50-percent ammonium sulfate-soluble fraction, and 75 percent ammonium sulfate-soluble fraction.

The pH was adjusted to neutral and solutions passed through the Zeis filter for sterility. Guinea pigs were sensitized to Candida albicans by a subcutaneous depot injection (adjuvant = lanolin and mineral oil) and the different fractions tested intradermally. Rabbits were more difficult to sensitize. Killed cells intravenously were used first in two courses and then a subcutaneous depot injection and finally two courses of living cells subcutaneously. Intradermal tests were then done with all the fractions.

It was found that the ammonium-sulfate fraction produced the most consistent positive results in both rabbits and guinea pigs.

Animals sensitized to Candida albicans failed to give positive reactions to extracts of four species of Candida and Sacchromyces, to Toxoplasmin, Coccidioidin and PPD. Further work on the specificity of this extract will be done.

Studies on the fixation pattern in amblyopia ex anopsia. P. J. Hauser, State University of Iowa, Iowa City, Iowa.

The so-called after-image transfer test of Brock and Givner was re-evaluated. The cases reported here, although small in number (25), demonstrated several rather specific factors.

Evidence from the tests indicates that some amblyopic eyes fixate eccentrically. However, the after-image transfer tests, as described by Brock and Givner, do not conclusively prove this eccentricity. By altering the procedure, the amblyopic eye can fixate centrally when adequate stimulus is given the eye for fixation. The vertical after-image light would appear to be such an adequate stimulus for many am-

blyopic eyes. The suggestion that the after-image cross test for anomalous retinal correspondence, when used on an amblyopic patient, is not dependable because the eccentric fixation on the light by the amblyopic eye cannot be accepted. It is most probable that eccentric fixation is a result of poor vision.

The awareness of a contralaterally induced after-image, such as occurs in this test, can be utilized to demonstrate not only the presence of anomalous retinal correspondence but also the angle of the anomaly.

In reviewing those patients who could not transfer the after-image to an unexposed eye we found them to be either too young for subjective testing or mentally retarded. Conclusions to be drawn concerning the absence of awareness of a contralaterally induced after-image must be guarded.

The effect of some newer ganglionic blocking agents on the eye. Frederick C. Blodi, M.D., University Hospitals, Iowa City, Iowa.

Some of the newer ganglioplegic drugs are now widely used in the treatment of vascular hypertension. They are usually well absorbed after oral administration and have a longer duration of action. In addition to the desired sympatholytic effect a certain parasympathetic blocking effect is unavoidable. This causes not only constipation and difficulty in urination, but also blurred vision and dazzling. The blurred vision is usually caused by cycloplegia and the dazzling is due to the dilatation of the pupil.

Three compounds were examined. One was Ansolysen the best known and oldest of these drugs. It is a pentamethonium derivative. Cycloplegia occurred only rarely. It was noted in younger patients when dosage was higher than 100 mg. It had no effect on the pupil or the intraocular pressure.

Ecolid is an asymmetrical quarternary ammonium base. It caused cycloplegia in practically all patients under 55 years of age. The pupils were dilated when more than 30 mg. Ecolid was given. The response of the pupil to miotics was prompt when pilocarpine was used, but unpredictable when a cholinesterase-inhibiting drug was administered. There was no obvious influence on the intraocular pressure.

Mecamylanine is one of the newest ganglionic blocking agents. It is a secondary anine with complete absorption after oral administration. We found a moderate cycloplegia and dilatation of the pupil when more than 5.0 mg. was given.

Comparative study of the bulbar pressure test and tonography: A preliminary report. M. F. Armaly, M.D., University Hospitals, Iowa City, Iowa.

The bulbar pressure test was described by Blaxter in 1953. He reported more positive results with this test in open-angle glaucoma than with tonography, especially in eyes with an intraocular pressure of less than 30 mm. Hg. A comparative study of both tests was performed on the same eyes. Tonography is done first (5.5 gm.) and 30 minutes later the bulbar pressure test is applied.

In 85 tests the bulbar pressure test gave a positive result (25 percent or less for outflow) whenever tonography gave a value diagnostic of glaucoma (C = 0.10 or less).

This report concerns 15 selected eyes in which the diagnosis of glaucoma was not made previously, and the intraocular pressure was 30 mm. Hg. or less. In these 15 eyes tonography gave values for C that varied between 0.12 and 0.22, values that do not occur exclusively in glaucomatous eyes as judged by Grant's and Goldmann's distribution curves for C in normal eyes. The bulbar pressure test in these eyes gave values for outflow of 12

to 25 percent, values that occur exclusively in glaucomatous eyes as judged by Blaxter's distribution curve. Ten of these eyes had a positive water-drinking test (a rise of 10 mm. or more) and seven had glaucomatous field changes to substantiate further the diagnosis of glaucoma.

The test was well tolerated by the patient and no injury to the cornea was encountered. In one eye in which the initial tension was 45 mm., a subconjunctival hemorrhage developed.

In these cases this test was more diagnostic of open-angle glaucoma than tonography.

The apparatus is simple and inexpensive and the test is easy to perform, which make it a valuable aid to the practicing ophthalmologist for the early detection of glaucoma.

The hypertensive reaction following anterior chamber paracentesis. Frank W. Newell, M.D., and Theodore Sheftel, B.A., Section of Ophthalmomolgy, The University of Chicago.

In recent years it has been generally accepted that paracentesis of the anterior chamber in experimental animals is followed in a short time by a transitory hypertension. In earlier studies it became evident that an immediate hypertension does not always occur and investigation was made into the factors responsible for the variation in response.

Rabbits were anesthetized with pentobarbital and 0.15 cc. of aqueous was removed through a 27-gauge needle. Tonography was done prior to paracentesis and at the conclusion of the experiment; tension was measured at five-minute intervals until static.

a. The hypertensive response was most likely to occur when the aqueous was rapidly removed. It was least likely to occur when the aqueous was removed slowly over a three- to five-minute interval.

b. The protein content of eyes with a transitory hypertension and those without increase in intraocular pressure was similarly elevated.

c. Irritation of the iris without paracentesis was not followed by hypertension, although vasodilation and the formation of plasmoid aqueous resembled that of eyes from which aqueous was removed.

d. The hypertensive response occurred so rapidly that factors of inflow and outflow were unlikely to be primary causes.

Experimental use of Versene and hyaluronidase in the removal of rust rings from the cornea. George J. Wyman, Peoria, Illinois.

Metallic particles were embedded in the cornea of dogs and rabbits through an intracorneal incision. In six dog eyes, after superficial curettement, the areas were treated with a 0.01-M solution of disodium versenate. No difference in the ease of removal was noted. Twelve rabbits eyes were stained by application of tincture of ferric chloride to the abraded cornea. Application of versenate solution appeared to improve the ease of removal over that of controls using a normal saline solution application.

Twelve rabbits eyes were tattooed with India ink. After two days the epithelium was removed and the pigment was curetted. It was removed with great difficulty. Application of hyaluronidase solution to the abraded cornea in dilution as strong as 500 viscosity units per cc. did not aid in the removal of the ink. It was concluded that neither agent, when applied topically, was of value in treatment of corneal rust rings.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

SECTION ON OPHTHALMOLOGY

January 20, 1955

DR. GEORGE F. J. KELLY,
Chairman pro tem.

HYDROPS CORNEAE FROM KERATOCONUS

DR. JOSE FIOL-BIGAS: The case presentation tonight is one of that very rare complication of keratoconus resulting from the rupture of the posterior surface of the cornea involving the endothelium, Descemet's membrane, and the corneal lamellae themselves.

Recently Dr. Townley Paton discussed a case he had had of this same complication which was handled by him in a manner different from that which I carried out. The results obtained by the procedure to be mentioned were most satisfactory.

The patient, a 22-year-old man had keratoconus diagnosed at the age of 12 years. Upon admission, a keratoconus of the left eye, rather extensive but without any serious or important complicating factors, was noted. The right eye was mildly irritated with a tremendous edema of the entire cornea. The thickness of the cornea at the limbus measured, as accurately as is possible under the slitlamp, over one quarter of an inch. This edematous cornea thinned very rapidly toward the site of the former keratoconus apex slightly below and nasal to the center of the cornea, where the edema decreased to about one eighth of an inch. In this way the corneal thickness reminded one of a cross-section of an anterior convex and a posterior highly concave lens of a meniscus type. The color of the cornea was a faint grayish blue and was barely translucent. One could not see the texture of the iris through its substance. Visual acuity was light perception and projection.

The keratoconus, in this varying bilateral state, had been unchanged for several years and had apparently been stationary. The patient was using contact lenses, had been using them for some time, and had had very satisfactory visual acuity, according to the history obtained from him. The right eye had been developing the complication present upon first examination for the past month to six weeks. It had become severe rather suddenly and abruptly in the 10 days immediately prior to his visit to the office.

The patient was admitted to the hospital and, shortly thereafter, under local anesthesia, a ring of eight deep diathermy punctures was made into the corneal stroma but not through it. A 1.5-mm. length Walker pin was used for this. It was remarkable to see an almost immediate beginning of corneal clearing by the drainage of the fluid, presumably aqueous, which had infiltrated into the corneal stroma. The eye was atropinized and a pressure dressing applied to the right eye, and a binocular bandage to both eyes.

Forty-eight hours later the dressing was removed in the operating room under general anesthesia, and a seven-mm. circular corneal graft was implanted with direct approximation sutures. At this time the corneal stroma was normal in appearance, in thickness, and in texture. There was no problem whatsoever connected with the corneal texture in so far as the introduction of the sutures was concerned. A normal resistance to the passage of the needle, and a normal resistance of corneal structure as the sutures were tied were noticed. Postoperative convalescence was quite uneventful and the patient's visual acuity at the present time is 6/6−4, wearing a plus 1.4D. sph. with a −11.0D. cyl. ax. 172.5°.

The corneal grafting has since been done to the left eye as well. Surgery on this side is so recent that the patient does not as yet

have his lens for that eye. Visual acuity at his last examination, however, several days ago, was 6/6−3, with a −11.5D. cyl. ax. 175°.

As stated, the reason for this presentation is to describe the result obtained from an eye which, at first examination, seemed to be in an almost hopeless condition, and the rapid favorable response from a relatively minor surgical procedure carried out prior to the grafting.

Apparatus for visual screening

Dr. Samuel M. Diskan (by invitation): The recent organized assault against inadequate visual screening programs in schools urgently demands that the ophthalmologist propose an answer to this ever-growing problem.

It has become increasingly obvious that tests for visual acuity alone cannot constitute an acceptable visual screening program.

The Atlantic City (Diskan) Eye Test was developed to detect at 20 feet (1) impaired visual acuity, (2) excessive manifest hyperopia, and (3) abnormal eye muscle balance.

The eye muscle screening test is original, and employs red and green light to suspend fusion and disassociate the visual functions of the two eyes. It measures lateral and vertical phorias simultaneously, and is an almost instantaneous method of separating the abnormal from the normal eye muscle balance.

A preliminary study of 799 Atlantic City school children by this test revealed 18 percent had impaired visual acuity; 2.4 percent excessive manifest hyperopia; and 1.4 percent abnormal eye muscle balance. Average testing time per child was 50 seconds.

The test was fast, effective, accurate, easily understood, and did not give excessive false referrals. The apparatus is inexpensive and easily portable.

The author feels that the Atlantic City Eye Test is an improvement over existing visual screening tests, and may be the answer to the agitation for an increased scope of visual screening in schools.

Oculomotor manifestations of brainstem lesions

Dr. Thomas R. Hedges, Jr. (by invitation), and Dr. Francis Heed Adler, presented three cases in which lesions of the brainstem produced unusual oculomotor manifestations.

The first was a case of unilateral internuclear ophthalmoplegia in a child in whom ventriculography showed a lesion in the region of the pons, causing a defect in the aqueduct and fourth ventricle. No autopsy was obtained but the clinical course and neurologic findings suggested that the etiology was an expanding lesion, possibly a pontine glioma.

The second case showed bilateral internuclear paralysis which progressed to complete loss of lateral conjugate gaze. Vertical movements and convergence were retained. The rapid regression of these findings suggested that the etiology in this case was disseminated sclerosis.

The third patient showed complete loss of vertical movements initially with a transient left hemiparesis. The patient recovered downward movements and upward following movement, but command movements in upward gaze remained absent for two and one-half years. A lesion, presumably vascular, in the region of the superior colliculus probably caused these motor defects, classified as an example of Parinaud's syndrome. (Illustrative movies were presented in each case).

Discussion. Dr. George P. Meyer: I would like to be enlightened about the innate transient nature of demyelinating diseases. I was under the impression demyelination was an irrevocable process. I think Dr. Hedges said this lesion may be of demyelinating nature, because this man recovered. May I hear some more about that?

Dr. Francis Heed Adler: One of the

characteristics of the demyelinating diseases is the rapidity with which they come on, and with which they change their character. Witness the scotoma in multiple sclerosis which is characteristically very sudden in onset, involving complete cessation of transmission of impulses so that there is an absolute scotoma, which in the course of a relatively very short period of time clears up entirely. The moment you get a picture of rapidity of change in a deep-seated disturbance of function, you say to yourself this is probably a demyelinating disease.

The same thing is also true of the motor side. Those deficits that occur in ocular motility of sudden onset and great variability which clear up rapidly point the finger to the demyelinating group of diseases. Not specifically multiple sclerosis, but Devics' disease, encephalomyelitis diffusa, Schilder's disease, and the other forms of demyelinating disease.

Dr. Hedges and I wish to emphasize tonight that there is great specificity of these syndromes in localization. This is a pretty tiny area of some centimeters running from the third- to the sixth-nerve nucleus, and you can pinpoint lesions by these phenomena very well.

Although we have great specificity in localization in the central nervous system, we would like to point out that our cases, and those in the literature, demonstrate that the same signs can be caused by any kind of pathologic alteration. The syndrome may be duct tumors, vascular disease, or demyelinizing disease.

Dr. E. Howard Bedrossian: Dr. Hedges is to be congratulated on his very informative paper. It is interesting to compare Dr. Hedges' second case with the cases of Moebius syndrome that were presented at the last month's meeting. In the case presented this evening, we have a definite acquired neurologic disorder of the brainstem, which gave the exact same findings of bilateral abduction and adduction paralysis (with the exception of the seventh-nerve paralysis) which is present in the Moebius syndrome. The Moebius syndrome, of course, is congenital and thought to be due to nuclear aplasia in some cases.

Last month I presented a case which had congenital bilateral paralysis of abduction and adduction due to peripheral changes in the muscles. This case also had the same clinical findings as Dr. Hedges' Case 2. Therefore, it is important to keep in mind the fact that these three different types of pathologic conditions may resemble each other clinically.

The history would be very significant in ruling out congenital from acquired paralysis of abduction and adduction. The forced duction tests would be very useful in differentiating peripheral muscle defects from a nuclear lesion in the congenital cases.

Coats' disease

Dr. William C. Frayer (by invitation) and Dr. Harold G. Scheie presented clinical and pathologic reports on two eyes from children showing complete retrolental membranes and enucleated because of a suspicion of tumor. Histologic evidence of massive subretinal hemorrhage with partial organization was found in both eyes. They were considered by the authors to be examples of the symptom complex known as Coats' disease. In one of the eyes no definite etiologic agent could be discovered to account for the subretinal hemorrhages. In the other eye, hemorrhages were thought to be associated with retinal changes secondary to subdural hematoma.

The differential diagnosis of pseudoglioma was reviewed. The current concept of Coats' disease was also discussed.

Discussion. Dr. William McCarty: It would be interesting to know if P_{32} studies were done.

Dr. William C. Frayer: No, sir. We did not do P_{32} studies. We felt that even a positive result would not have altered our decision to enucleate these eyes.

William E. Krewson, 3rd,
Clerk.

YALE UNIVERSITY

CLINICAL CONFERENCE

April 25, 1955

Dr. R. M. Fasanella, *presiding*

Radioactive isotopes in diagnosis

Dr. Edwin B. Dunphy, Boston, noted that most cases of intraocular neoplasm can be diagnosed by clinical means. Occasionally, the diagnosis is difficult or mistaken. The preferential uptake of some radio-isotopes makes them useful diagnostic aids. In brain tumors, radioactive phosphorus as P_{32} in sodium phosphate has been of value. This beta-ray emitter allows the use of a probe type of diagnosis. In ophthalmology P_{32} has been found to concentrate in vascular tissues, such as choroid and retina, and in slightly higher concentration in tumors. Later a marked difference in counting rate was found when the counter was applied to the outer surface of the intact sclera. Eight scleral quadrants are used for this purpose. Studies done in Philadelphia originally showed normal variations in different quadrants in normal eyes, up to about 28 percent. Therefore, it would seem that over 30 percent difference is necessary for diagnostic purposes.

Serous detachments, vitreous hemorrhages, and so forth, show no preferential uptake. However, large inflammatory lesions may have a preferential uptake and have to be distinguished clinically from tumors. Radioactive iodine as I_{131} was tried with poor results in England. This is a gamma emitter and disturbing radiations from adjacent areas were found to interfere.

Dr. Dunphy has used P_{32}, which has a half-life of 14 days and seems most valuable at the present time. He presented a series of 35 cases. Of 11 proven cases, seven were accessible to the counter and showed positive results. In four cases there was poor accessibility and the results were not satisfactory. A curved counter for the macular area has not proved too satisfactory. There were seven eyes with lesions of the iris on which biopsy was done. Two benign cysts showed negative tests; two malignant melanomas showed positive tests. Two leiomyoidomas of the dilator fibers showed negative tests. One leiomyoma gave a negative test.

Several cases without biopsy were presented. One case, clinically diagnosed as malignant melanoma of the iris in an only eye, had a negative result. Operation was not advised. One case clinically diagnosed as malignant melanoma showed no change in 15 years and had a negative test. One case of endophthalmitis had a positive test. Serous detachments of the retina showed negative tests.

The radioactivity of subretinal fluid in relation to venous blood showed the blood level to be higher than the subretinal fluid in all cases. Counts of eyes with detachments tended to be less than those of normal eyes, which possibly is due to the retina being more remote from the counter.

Successive readings up to 48 hours after injection of P_{32} showed a progressive fall, but the tumor eye tended to retain the P_{32} longer than the normal eye. Therefore, comparisons are now made 24 hours after the injection of P_{32} rather than within a few hours. The present method used is:

Sodium phosphate is given intravenously (20 mc./kg.) maximum dose, 1,000 mc. Children under the age of 12 years receive less, approximately 8.0 mc./kg. Twenty-four hours later counting is begun with the patient in the prone position. Both eyes are anesthetized with pontocaine and directed in suitable position. An end-window or the 45-degree angle counter is used. One must have absolute quiet so that the patient doesn't move his eye.

A count is done for one minute on the test eye and then on the fellow eye. It is repeated once or twice to get an average. A criterion for a positive result is at least a 30-percent difference. Dr. Dunphy felt a 50-percent difference is better. In the case of an only eye, one compares the test areas with an opposite area of the same eye.

Dr. Dunphy then discussed the test limitations:

1. Posterior segment tumors inaccessible to close application of the counter do not give a positive test and, even after 24 hours, may be unreliable. Possibly a new counter may be of help.

2. Small flat tumors may not show a significant rise in the counting rate. The tumor would have to be of sufficient size to displace some vitreous, since the normal choroid and retina have a rather high uptake rate.

3. Errors in technique include: Tipping the counter which gives faulty results. Also application over the extraocular muscles might give a false high reading. If absolutely necessary, it can be compared to a similar area on the normal eye.

4. An active large inflammatory lesion will give a false-positive result and must be differentiated clinically. Leopold says the tumor tends to retain radioactivity longer than an inflammatory area and it is possible that two criteria here would be available: (1) At least 30-percent higher after one hour; and (2) even more than that 24 hours later.

5. Radioactive isotopes should be considered a diagnostic aid, not an absolute test. A negative result does not exclude malignancy.

Discussion. Dr. Chang (radiologist): I agree that the test so far is a diagnostic aid, not an absolute test and also that measurement after 24 hours is important and that measurement in the first few hours is very accurate.

Dr. L. Lovekin: Do you hospitalize the patient?

Dr. Dunphy: No. Injection is given one day and the test is done the next day.

Dr. Lovekin: Have any adenocarcinomas been tested?

Dr. Dunphy: I have had none but elsewhere adenocarcinomas have shown differential uptakes as with malignant melanoma.

Dr. Yudkin: Have you tested any active choroiditis?

Dr. Dunphy: In one case, probably choroiditis, it showed a positive test, but no surgical procedures were done and the process subsided.

Dr. Clark: Do you open the conjunctiva at all?

Dr. Dunphy: Not ordinarily, except when trying a curved counter at the macula.

Dr. ———: Has it been tested on retinoblastoma?

Dr. Dunphy: In the first series, three eyes were tested after enucleation and were positive. Leopold has tested three or four in vivo and the test is difficult under general anesthesia since electrical apparatus is used. In the usual case clinical findings demand an enucleation anyway.

Dr. Freeman: The condition of tumors with great variability in necrosis within the tumors may determine the response to the test. Also, in the type of tumor that spreads laterally, it is possible that counts may overlap and may not be diagnosed as easily. Most of the malignant melanomas are posterior tumors. I also believe the enucleation must not be rushed and one must have time to study the case carefully.

Dr. Dunphy: I agree with the difficulties mentioned and with the advice not to rush your diagnosis.

William Glass,
Recording Secretary.

MADRID OPHTHALMOLOGICAL SOCIETY

March 24, 1955

Dr. Marin Amat, *presiding*

Tonsil and wound infections

Dr. Aguilar Muñoz presented a 60-year-old patient who suffered an uneventful cataract operation, as well as postoperative course. Twenty-two days later she returned with the eye painful and inflamed and with pus on the corneal wound. An angina was

also observed. With antibiotics the process was controlled. Three months later it reappeared and again antibiotics and a vaccine obtained from the infected tonsil normalized the eye and made the angina disappear. Five days later the symptoms reappeared for the third time and tonsillectomy was advised. After electrocoagulations of the infected tonsil the patient was cured. The author stressed the relationship between the tonsil and wound infection. The retraction of the wound left an astigmatism of 14D. cyl. ax. 10°.

Discussion. Dr. Bartolozzi mentioned that the drawings showed the infection partly outside and partly inside the wound and believes, in addition to admitting a "lowered resistance," that the conjunctivo-conjunctival sutures used by Dr. Aguilar Muñoz would not be enough of a barrier to the infection. He recommends the corneoscleral conjunctival sutures, following the Castroviejo technique. In a similar case he employed penicillin subconjunctival injections more successfully than intramuscular injections.

Dr. Marin Amat considered two points of special interest:

1. The fact that, in spite of parenteral antibiotics postsurgery, the angina appeared.

2. The fact, which he considers paradoxic, of an ocular metastasis from a tonsil infection instead of tonsil infection coming from the eye focus.

The explanation of this paradox, as well as of the selective action of the pathogenic bacteria from the infected tonsil, may be considered as similar to that of the relatively frequent infection of the filtering wounds in fistulization glaucoma surgery. Therefore he believes that the cataract technique of a conjunctival flap or a conjunctival bridge increases the chance of an exogenous infection or, as in this case, an endogenous infection.

Dr. Marin Amat prefers a pure limbal flap and a previous corneoscleral suture.

Dr. Aruilar Muñoz agreed that the first attack was a true bacterial metastasis and that the other two attacks were probably allergic in nature. He answered Dr. Bartolozzi by saying that the best type of suture to be used was still a matter of discussion; he believes every surgeon will practice that type which in his hand has given him best results. He agreed with Dr. Marin Amat that some conjunctival flaps frequently produced filtering wounds but he also pointed to the frequency with which wounds did not heal, delaying the formation of the anterior chamber and producing iris hernia even after the employment of the most solid corneoscleral sutures.

Olga Ferrer,
Translator.

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OPHTHALMIC SURGERY

For many years the American Board of Ophthalmology has debated the question of whether or not to have a special and comprehensive examination in ophthalmic surgery beyond that which has been, for some time, an integral part of the Board examinations. Many members of the Board, over these years, believed that the usual examination was not good enough to determine adequately the candidates' skill and training in surgery of the eye. As part of the discussion, the idea of giving a higher certificate or diploma in ophthalmic surgery was considered. For many reasons the plan was discarded and probably will not be resurrected.

In the last few years, the American College of Surgeons has tightened up its re-

quirements for admission to Fellowship. As part of this effort to improve the quality of its membership, the Board of Regents of the College in 1955 replaced ophthalmology with ophthalmic surgery as a classification for Fellowship. The following is the official announcement to this effect, published in the May-June, 1956, *Bulletin*, page 125:

This is in line with the thinking that ophthalmologists who are Fellows of the American College of Surgeons should be practicing a substantial amount of major ophthalmic surgery. Criteria (see below) for Fellowship in the new classification were submitted upon request by the Advisory Council on Ophthalmology and were approved by the Board of Regents at its February, 1956, meeting.

Applicants for Fellowship in 1956 in ophthalmology were deferred for one year, and the new criteria will be used in evaluating their eligibility.

Fellows who wish to qualify under the new classification may do so by application to the director, and proving to the satisfaction of the Central Credentials Committee that they meet the criteria.

The requirements for Fellowship in ophthalmic surgery are as follows:

1. Graduation from a medical school acceptable to the American College of Surgeons.

2. Seven years devoted to special training and practice from the date of graduation from medical school.

3. Satisfactory completion of at least one year of internship in a hospital approved for that purpose by the Council on Medical Education and Hospitals of the American Medical Association, or by the council of the Royal College of Physicians and Surgeons of Canada.

4. Residency training which will permit the applicant to take the examination for certification by the American Board of Ophthalmology, or the examination for Fellowship in the Royal College of Physicians and Surgeons of Canada.

5. Completion of at least six years of practice following the end of formal graduate training.

6. License to practice in the applicant's respective state, province, or county (unless he is a full-time regular appointee in a federal medical service).

7. Professional activity of a character to classify the applicant as a specialist in surgery (investigation of the applicant's surgical experience and ability will be made by one or more Fellows).

8. Moral and ethical fitness, as determined by reports of surgeons used as references, by appropriate credentials committees, and by the director.

9. Professional proficiency as determined by the submission of 30 (preferably consecutive) cases that the applicant has operated upon, in which are given a brief summary of his preoperative notes, a photostat of the hospital record (if photostatic equipment is not available at his hospital, certified copies will be acceptable), and a summary of his follow-up notes, including pathologic reports if any. These cases should be major ophthalmic surgical cases, including operations for cataract, glaucoma, retinal separation, diseases of the lacrimal system, severe traumatic lacerations, squint, and plastic reconstruction. In the case of glaucoma, copies of the visual field and tonometric readings, pre- and post-surgery, must be included. In the case of squint and plastic reconstruction, pre- and postoperative photographs illustrating the deformities and lesions shall also be included.

(This part of the requirements is waived in the case of an applicant who has professorial status. It may be waived for any applicant by unanimous vote of the Board of Regents.)

10. Approval of the Board of Regents, as shown by unanimous vote of election.

In ophthalmic surgery, as in other classifications, the Board of Regents may determine the requirements for admission to Fellowship at any time, upon recommendation by the Central Credentials Committee; and for each applicant the Board of Regents shall make the final decision as to eligibility for Fellowship.

There is no doubt that in time the quality of Fellowship in the College, as it pertains to ophthalmology, will become better and better. It will be an honor, a distinction, and a privilege to be a Fellow of the College under these conditions. It will have an important effect upon the training programs for ophthalmic surgery in schools and hospitals. It will consequently insure that the patient has better eye surgery done on him, not only technically but, which is perhaps more important, there will be better judgment and ethics displayed by the surgeon, for these factors will be most carefully weighed by the credentials committee. Furthermore, as is well known now, the College will not tolerate a member who is guilty of violating medical ethics.

As part of this stern regard for the principles and practices of medical ethics, the Board of Regents (1955) has ruled that it is unethical for ophthalmologists to dispense their own glasses unless there is no independent optician available for this purpose. The exact wording of this rule has not, as yet, been established, but the principle has

already been adopted. It is, as yet, not clear whether those Fellows who dispense will have to give up this practice or resign from the College. This matter is under consideration, but the new rule does apply to candidates, as of now.

The standards for admission into the College are now high indeed and those who succeed in becoming Fellows have a right to be proud of their achievement and of their College.

Derrick Vail.

OBITUARY

ARNOLD KNAPP
(1869-1956)

Arnold Knapp, dean of American ophthalmologists, died in New York on February 29, 1956, in his 87th year. He was born in New York in 1869, the son of the noted Herman Knapp. Graduating in arts from Harvard in 1889 and from the College of Physicians and Surgeons, Columbia University, in 1892, he filled a surgical internship at Roosevelt Hospital and then proceeded to Europe for his initial training in ophthalmology. On his return from abroad, he joined his father in practice and consequent duties at the New York Ophthalmic and Aural Institute.

This hospital had been established on the lower east side of New York by the elder Knapp in the year that the younger man entered medical school. It continued under Herman Knapp's direction until he resigned for ill health in 1909, and was succeeded by his son. In 1913, two years after Herman Knapp's death, the institute changed its name to the Herman Knapp Memorial Eye Hospital and moved to West 57th Street. It remained here under the direction of Arnold Knapp until its merger with the Institute of Ophthalmology of the Presbyterian Hospital in 1940. In this year Dr. Knapp established the Knapp Memorial Foundation, dedicated to teaching and research in ophthalmology. This made possible the excellent contributions of the Knapp Research Laboratory under the guidance of von Sallmann and the Knapp Laboratory of Physiological Optics under Hardy and his successors.

The amount of work done by Arnold Knapp was prodigious. He was director of a hospital for more than 30 years, professor of ophthalmology at Columbia for 25 years, editor of the *Archives of Ophthalmology* (founded by his father the year Arnold was born) for 40 years. In the meantime he found time to conduct a large practice, to write more than 200 papers, to publish a classic book on *Medical Ophthalmology*, to indulge his interest in music, literature, and art, and to add to his collection of Chinese bronzes.

He was chairman of the Section of Ophthalmology of the American Medical Association in 1925 and chairman of the American Ophthalmological Society in 1931. In 1946 he delivered the Bowman Lecture, entitled, "The present state of the intracapsular cataract extraction," the second American to be so honored. Other distinctions included an honorary doctorate in science from Columbia in 1931, the Howe Medal of the American Ophthalmological Society in 1937, and the Leslie Dana Gold Medal of the National Society for the Prevention of Blindness in 1937.

Arnold Knapp was profoundly influenced by the era in which he lived and the distinguished men who made it remarkable. He was a year old when von Graefe died, 20 years of age on the death of Donders, and in his forties when the careers of Hutchinson and Lister ended. While he was at Harvard, Oliver Wendell Holmes was still living nearby. During his medical course at Columbia great works were pouring from the pens of Bowman, Huxley, von Helmholtz, Brown-Sequard, Virchow, Paget, and Pasteur. He was already a doctor of medicine when the first X-ray picture was taken and was in practice when

ARNOLD KNAPP, M.D.

Gullstrand was receiving the Nobel Prize. He knew Koch, Saemisch, the Pagenstechers, Javal, Parinaud, Holmgren, and, indeed, most of the illustrious doctors of his time. His life extended to include friendship with nearly all of the distinguished moderns, some of whom, such as Fuchs, Gonin, Morax, Haab, Vogt, Koller, Schiøtz, Roenne and Duane, were known to many ophthalmologists still living.

Arnold Knapp's mind was penetrating, judicial, and orderly. Consequently his writing was clear, his speech precise. He was a strict and exacting teacher but the rigors of his regime were compensated for by contact with one of the greatest clinical minds that ophthalmology has known. Moreover, every former resident can look back with gratitude to many an act of kindness and generosity. His influence on his students ranks high among his contributions to ophthalmology.

Dr. Knapp is survived by four children, Miss Elizabeth Knapp, Mrs. Ellen Morandiere, John, and Philip, who is an ophthalmologist on the staff of the Institute of Ophthalmology. A sister, Mrs. Maud Knapp Cox, also survives.

Arnold Knapp walked among the great and was not the least of them. The mores and men of ophthalmology are changing, and we have bidden farewell to the last of the giants.

Gordon M. Bruce.

CORRESPONDENCE

OPERATION FOR SENILE ECTROPION

Editor,
American Journal of Ophthalmology:

Regarding the article on senile ectropion (Am. J. Ophth., **39**:756 [May] 1955), I think the operation which gives most satisfactory results is one which involves the combined excision of the tarsus and the conjunctiva. I have done about a hundred during the last few years.

The lid and the conjunctival sac are anesthesized with two-percent novocaine and adrenalin. The lid is everted on MacCallan's spatula by fixing the edge of the lid with fixation forceps to get the whole inner surface of the lid in view; a horizontal incision is then made at the lower border of the tarsus from the inner to the outer at the junction of the retrotarsal fold going only through the conjunctiva. Then with narrow bladed strabismus scissors the conjunctiva is dissected backward to the limbus. Another horizontal incision is made from the edge of the lid (1.0 to 1.5 mm.) going through the whole thickness of conjunctiva and tarsus but not deeper from inner to outer border of the lid, taking care not to perforate the skin.

With the fixation forceps take hold of the outer part of the tarsus and dissect it with scissors from the underlying tissues (orbicularis), taking off only the conjunctiva and tarsus. The edge of the lid is sutured

to the conjunctiva by three interrupted sutures to close the wound in the following manner. Make the middle suture first, about 2.0 mm. below the lashes, through the lid and then through the edge of the conjunctiva and out; then in again through the conjunctiva 3.0 to 4.0 from the first suture and then through the lid from the inner surface to the outside about 2.0 mm. from the lashes; then tie it, but not tightly; then put the other two sutures, one in and the other out, in the same way as the first, and tie them all close to the eyelashes. The eye is closed, then a wet dressing, which is changed daily is applied, stitches are removed on the third day, the bandage on the fourth or fifth days, and then the eye kept open.

(Signed) Abdel Messih Girgis, M.D.,
Cairo, Egypt.

Fundus changes in postoperative hypotony

Editor,
American Journal of Ophthalmology:

In the December, 1955, issue of The Journal, Dr. Angelos Dellaporta describes fundus changes in postoperative hypotony. There are several points in the article which I would like to discuss.

1. The statement is made that papilledema in ocular hypotony is not common. This condition is actually quite common in ocular hypotony following intraocular surgery. If one will carefully examine the fundi in all cases of hypotony following intraocular surgery, he will find that papilledema is very common, occurring in perhaps 50 percent or more of these cases.

2. The statement is made that papilledema occurs usually after antiglaucomatous surgery, especially after the various types of fistulizing operations or after perforating eyeball injury. Actually, the condition is quite common in hypotony following cataract surgery.

3. The statement is made that no retinal hemorrhages occur. It is a fact that retinal hemorrhages adjacent to the disc are quite common in papilledema in postoperative hypotony. A very striking example of that was in a recent case of uncomplicated intracapsular cataract extraction. After the operation was finished, not only was papilledema evident but the disc, as well as the surrounding retina, showed many hemorrhagic areas. I have seen many other cases of retinal hemorrhage with papilledema which occurred as a result of hypotony following intraocular surgery.

The term "papilledema ex vacuo," which Dr. Dellaporta considers appropriate for the condition of papilledema occurring with hypotony, is not accurately descriptive. A vacuum does not exist in such a condition. The pressure is either atmospheric or above.

(Signed) Everett R. Veirs,
Temple, Texas.

Dr. Dellaporta's reply

Editor,
American Journal of Ophthalmology:

This is in reply to the remarks of Dr. Veirs concerning my paper, "Fundus changes in postoperative hypotony" in the December, 1955, issue of The Journal.

Concerning points 1 and 2 of Dr. Veir's letter: The postoperative ocular hypotony mentioned in my paper is not the naturally expected hypotony which follows the surgical opening of the eyeball but that which persists after cicatrization of the surgical wound. We have to distinguish (a) the hypotony which persists after completion of cicatrization of the surgical wound and (b) the hypotony which follows every surgical opening of the eyeball.

Let us consider the first type: After nonfistulizing operations such as the cataract operation, the incidence of persistent hypotony is, as we all know, an infrequent complication which was discussed lately in a paper by Dr. J. H. Dunnington (Brit. J. Ophth., **40**:30, 1956).

After fistulizing operations there are, of course, more cases of persistent hypotony. However, an analysis of 195 cases of iridencleisis showed an incidence of only six percent free fistulizing scars with Seidel's fluorescein test (A. Dellaporta, Acta Ophth., **26**:413, 1948); and only in these cases might one expect persistent hypotony. In 730 cases of cyclodialysis, M. Vannas and B. Björkheim (Acta Ophth., **30**:63, 1952) found only 27 cases with hypotony persisting for at least one year. These citations are sufficient to show that persistent hypotony after completion of cicatrization of a surgical wound is rare.

Let us now consider the second type, that is, the natural hypotony following any surgical wound of the corneoscleral capsule. According to the tonometric studies of E. Custodis (Ber. D. Ophth. Ges., **55**:79, 1949) who measured the tension of eyes operated for cataract two days to several weeks after operation, the majority of these eyes showed hypotony lasting for several weeks. If we apply the statement of Dr. Veirs that "in perhaps 50 percent or more of these (hypotony) cases" a papilledema is found, we must expect papilledema in about 50 percent of all cataract operations. I failed to find in the literature any statement confirming such an occurrence. World-renowned surgeons such as H. Arruga (*Ocular Surgery*, New York-Toronto-London, McGraw-Hill Book Co., Inc., 1953, p. 516), Meller-Böck (*Ophthalmic Surgery*, New York, The Blakiston Co., 1953), Spaeth (*Ophthalmic Surgery*, Philadelphia, Lea and Febiger, 1944, p. 663) do not mention the occurrence of papilledema after cataract surgery though they mention consistently such relatively rare complications without serious consequences as choroidal detachment. Is it possible that these experienced surgeons failed to inform their readers about a complication which, according to Dr. Veirs, occurs in such a great percentage of cases? Furthermore, the pathogenesis of papilledema in ocular hypotony was first recognized by C. Behr (Klin. Monatsbl. f. Augenh. **50**:56, 1912) exclusively in cases of perforating injury of the globe. If the occurrence of papilledema in hypotony is so common after intraocular surgery, as Dr. Veirs finds, one might wonder how the earlier surgeons could have failed to detect and describe that condition in their easily accessible surgical cases, and had to resort to eyes with perforating injuries.

In point 3 of his letter Dr. Veirs states that, "It is a fact that retinal hemorrhages adjacent to the disc are quite common in papilledema in postoperative hypotony." In the literature available to me which deals with clinical and experimentally produced papilledema in ocular hypotony (E. Treacher Collins and J. S. Hinnel, Tr. Ophth. Soc. U. Kingdom, **21**:100, 1901; Judin: Klin. Monatsbl. f. Augenh., **46**:99, 1908; Lohlein, W.: Ztschr. f. Augenh., **20**:364, 1908; Gilbert, W.: Arch. f. Ophth., **77**:199, 1910; Behr, C.: Klin. Monatsbl. f. Augenh., **50**: 56, 1912; Treacher Collins, Tr. Ophth. Soc. U. Kingdom, **36**:204, 1916; Klauber, E.: Klin. Monatsbl. f. Augenh., **60**:764, 1918, and Klin. Monatsbl. f. Augenh. **61**:180, 1918; Friede, R.: Klin. Monatsbl. f. Augenh., **64**:783, 1929; von Horvath, B.: Klin. Monatsbl. f. Augenh., **71**:698, 1923; Popovic: Zentralbl. f. Ophth., **15**:117, 1925; Kyrieleis, W.: Arch. f. Ophth., **121**: 560, 1929; Eppenstein, H.: Klin. Monatsbl. f. Augenh., **85**:672, 1930; Lindberg, J. G.: Acta Ophth., **10**:101, 1932; Smith, G. E.: Arch. Ophth., **21**:856, 1939; Pau, H.: Klin. Monastbl. f. Augenh., **117**:591, 1950) I could find but one dog's eye (Kyrieleis) in which two small hemorrhages were described near the edematous disc. In the detailed reports of the above-cited authors, no retinal hemorrhages are described. One must, therefore, suspect that the frequent hemorrhages seen by Dr. Veirs in his cases were produced by other causes.

An exception is the papilledema and the retinal hemorrhages seen after successful medical or surgical treatment of acute glaucoma, where they are not uncommon. How-

ever, these fundus changes occur, as is well known, during the glaucomatous attack, that is, during the increased intraocular pressure which is the very opposite of an ocular hypotony. Both papilledema and retinal hemorrhages might increase as result of the sudden drop of intraocular pressure after successful medical or more often after surgical treatment. These fundus changes are usually observed after the glaucomatous attack because in most cases the hazy cornea does not permit accurate opththalmoscopy during the attack.

As far as the term "papilledema ex vacuo" is concerned, it has been used in the German literature for many decades, and I think it is a suitable term for the condition. According to the general concepts of the pathogenesis of the papilledema in ocular hypotony (Duke-Elder: *Textbook of Ophthalmology*, 1947, v. 3, p. 2945), the normal intraocular pressure is capable of counteracting the normal tension of the cerebrospinal fluid existing in the optic nerve sheaths and the optic disc remains flat. If the intraocular pressure drops, there is creation of a relative vacuum within the ocular capsule compared to the steady tension in the optic-nerve sheaths, and the cerebrospinal fluid pushes the optic disc toward this reduced resistance, or relative vacuum in the ocular capsule.

I think, therefore, that the term "papilledema ex vacuo" is appropriate to describe the papilledema in ocular hypotony. There should, of course, be no objection to the introduction of an even more suitable term.

(Signed) Angelos Dellaporta,
Buffalo 14, New York.

BOOK REVIEWS

ANESTHESIA IN OPHTHALMOLOGY. By Walter S. Atkinson, M.D. Springfield, Illinois, Charles C Thomas, 1955. 101 pages, 44 figures, bibliography, index. Price: $3.25.

This slender monograph, publication number 251 of the American Lecture Series® edited by Donald J. Lyle, M.D., contains within its well-printed pages a most comprehensive discussion of a subject of great importance to ophthalmic surgeons. Dr. Atkinson has been a student and eloquent writer of this subject for many years and his contributions in this field have become authoritative. This present work, small enough to be slipped into your pocket and readable enough to permit you to grasp its important subject matter almost in the time it takes you to go to and from your labors, sums up most adequately the present knowledge of anesthesia in ophthalmology.

Directions and dosages are meticulously detailed, illustrated with excellent photographs and figures, and enlivened with clever cartoons, each carrying an appropriate "punch line" pointing up the subject. The writing reflects the wide experience of the author, and there is no excess verbiage.

No ophthalmic surgeon worthy of his grave responsibility should fail to own and study this fine book.

Derrick Vail.

1955-56 YEAR BOOK OF EYE, EAR, NOSE, AND THROAT. Edited by Derrick Vail, M.D., and John R. Lindsay, M.D. Chicago, Year Book Publishers, 1956. 472 pages, 121 illustrations, author and subject indices. Price: $6.50.

This hardy perennial, planted in 1900, still blooms every spring and flourishes even more vigorously since transplanted to its present vale. In the choice of significant selections from the past year's vast output of ophthalmologic literature, Vail's seasoned judgment is evident. An extra dividend to the journal club of *Year Book* readers are the pithy, pointed comments of their critical monitor.

The contents cover publications received between October, 1954, and September, 1955. The careful index, which ranges from

abiotrophy to Werner's syndrome, is extremely useful as a key to late literature. Fairly recent references can thus be traced when an omnivorous reader has forgotten, as often happens, just where a particular article appeared. Unless an oculist keeps abreast with the literature that the *Year Book* surveys, ophthalmology passes him by, as the concepts, techniques, and therapy of yesterday are gradually transformed.

James E. Lebensohn.

TRANSACTIONS OF THE AMERICAN OPHTHALMOLOGY SOCIETY, 1955, Volume 53. New York, Columbia University Press, 1956. 522 pages, index. Price: Not listed.

The active members of the society number about 200, but most of the papers presented are being reprinted with due acknowledgment in THE JOURNAL and hence reach the world-wide audience that their excellence merits. For the lively, ample discussions that follow each paper, however, the *Transactions* must be consulted. Verhoeff's remarks display his characteristic irascible insight. His own article evinces a sempiternal mastery that seems to show how far the gulf stream of our life may flow. A new type of toy auto produced the idea for the development of an electric trephine with automatically retracting blade that is now in manufacture. Holmes of Honolulu has an interesting paper on hereditary congenital ophthalmoplegia in a Chinese family. Koch recommends paredrine (one to three percent) as the best and safest agent for the dilatation of the pupil in glaucoma. Scheie finds that in chronic wide-angle glaucoma the water provocative test is a more reliable diagnostic criterion than tonography. Cogan describes additional cases of corneoscleral lesions in periarteritis nodosa showing a paralimbal keratitis similar to Mooren's ulcer.

The theses of the three new members, which are published but not read, occupy about one third of the volume. Henderson's analysis of 119 intracranial arterial aneurysms in which arteriography was performed in 91 cases is a most detailed and definitive contribution to the subject. Jervey concludes from a careful study of the effect of tonometry on the cornea that methyl cellulose (one percent) should be instilled just before the instrument is applied. Smell explores the mysterious inertia of the iris in healing and suggests that the iris stroma exhibits an inherent weakness of proliferative capacity and that the chemical climate in the anterior chamber exerts an antiproliferative effect.

The minutes relate that the American Board of Ophthalmology has certified 4,165 ophthalmologists and that, in the 1955 written test, 160 of the 238 candidates passed.

James E. Lebensohn.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

6

OCULAR MOTILITY

François, Jules. **Muscle transplantation in the treatment of ocular palsies.** Ann. d'ocul. **188**:927-945, Oct., 1955.

The author describes his technique for treatment of paralysis of the external rectus muscle by partial transplantation of the vertical recti, combined with resection of the external rectus. Perfect results were obtained in 13 out of 14 cases. In 10 cases the amount of abduction attained was 40 degrees or more, in two cases 30 degrees, and in one case 25 degrees. Exotropia was sometimes observed following the operation. This responded satisfactorily to exercises in all but two cases, where persistence of a low degree of exophoria necessitated a later resection of one of the internal rectus muscles. Postoperatively, there was usually a slight narrowing of the palpebral fissure on the operated side. The mode of action of the operation is purely mechanical. (14 figures, 14 references) John C. Locke.

Halbron, P., and Paquet, C. **Examination of the ocular motility.** Ann. d'ocul. **188**:946-960, Oct., 1955.

Current techniques in common usage are described. (7 figures) John C. Lock.

Harada, M. **Anomalous retinal correspondence in strabismus. Report I.** Acta Soc. Ophth. Japan **60**:15-22, Jan., 1956.

This is a report of cases of squint with anomalous retinal correspondence, the development of which is hardly explained by an adaptation phenomenon. It includes some cases of intermittent squint in which an anomalous correspondence was demonstrated; one case in which the angle of the anomalous correspondence was considerably greater than that of the squint; and one case of exotropia with hypertropia in which two anomalous correspondences were demonstrated. In these cases the squint does not seem to be the cause of the development of the anomalous correspondence by an adaptation phenomenon, but the squint may be developed secondary to the anomalous correspondence. (3 figures, 27 references)

Yukihiko Mitsui.

Hartman, Edward. **Bielschowsky's test.** Ann. d'ocul. **188**:859-863, Sept., 1955.

Bielschowsky's test and its significance

in paralysis of the superior oblique muscle are described. (3 figures, 2 references)

John C. Locke.

Hartmann, Edward. **Hering's law and its importance in the diagnosis and treatment of oculomotor palsies.** Ann. d'ocul. **188**:708-714, Aug., 1955.

The author reviews Hering's law and its significance in oculomotor palsies.

John C. Locke.

Hartmann, Edward. **The effect of strabismus on the psychology of the child.** Ann. d'ocul. **189**:65-72, Jan., 1956.

Emotional disturbances may be the cause of strabismus or may be entirely secondary to it. To differentiate the two types of disturbance one has to observe the effect of successful treatment on the child's behaviour. Psychologic anomalies caused by strabismus are varied and important and occur sooner than one would expect. This is a strong argument in favor of early operation. (8 references)

John C. Locke.

Malbran, E. S., and Norbis, A. **D.F.P. in the treatment of convergent strabismus.** Ann. d'ocul. **188**:720-733, Aug., 1955.

The authors used D.F.P. in 109 cases of convergent strabismus. Partial or complete improvement was obtained in 71 percent of accommodative esotropias, in 81 percent of partially accommodative cases, and in 40 percent of non-accommodative types. In no case did the strabismus increase. The treatment was particularly effective in intermittent esotropia and in postoperative residual esotropia of accommodative origin. It was almost always unsuccessful in patients with associated vertical deviations, paretic or optical anomalies. Suppression and amblyopia were not insurmountable obstacles. In many cases, D.F.P. permitted the patient to dispense with glasses.

In 75 percent of all patients examined with the biomicroscope iris cysts were found. These were more frequent after prolonged use of a miotic. They varied in size, number and shape, sometimes covered almost the entire pupillary area. They affected preferentially the nasal margin of the pupil and disappeared a few weeks after cessation of the use of a miotic. They occurred more rapidly and frequently in darkly pigmented eyes. Apart from these iris cysts, D.F.P. must be considered innocuous for the strabismic eye, even when used for long periods. Conjunctival follicles did not appear, as with the use of eserine and pilocarpine. Pilocarpine (up to 50 percent) and eserine (up to 1 percent) also gave more variable results. Headaches were more frequent and severe with eserine than with D.F.P. Nausea and headache sufficient to require the withdrawal of D.F.P. occurred only once. (2 tables, 18 references) John C. Locke.

McAlpine, Stuart G. **Recurrent oculomotor palsy in diabetes mellitus.** Scottish M.J. **1**:44-45, Jan., 1956.

Diabetes mellitus in a 68-year-old woman, complicated by paresis of the third cranial nerve is described. The paresis occurred first on the left side, and six months later on the right side. Complete recovery from the left-sided lesion occurred after three months and partial recovery from the right-sided lesion in two months. The prognosis is good. (9 references)

Irwin E. Gaynon.

Oláh, Émile. **Insufficiency of the capacity of gaze.** Ophthalmologica **130**:321-328, Nov., 1955.

The anomaly of gaze which the author has encountered in only one case, is characterized by inability to move both eyes in certain directions by the straight, direct route. Movements in these directions can, however, be accomplished in an indirect fashion, that is by making one or several detours. The author believes this

condition to be sufficiently different from the paralyses of gaze to warrant the term "insufficiency of the capacity of gaze." (7 figures) Peter C. Kronfeld.

Rama, G. **Conjunctival strabismus.** Gior. ital. oftal. **8**:418-425, Sept.-Oct., 1955.

The author discusses a few cases of squint in which, in addition to anomalies of muscles and fascia, abnormalities of the conjunctival tissues were found which did not allow free abduction of the eye after tenotomy or recession of the internal rectus muscle. In these cases grafts of labial mucous membrane in the incisional gap of the conjunctiva over the insertion of the internal muscle rectus were effective. (3 figures, 7 references)

V. Tabone.

Toselli, C., and Venturi, G. **The cover test.** Gior. ital. oftal. **8**:470-481, Nov.-Dec., 1955.

The test, likely errors, and a few modifications are described. Clinical factors associated with the test are briefly discussed. (1 figure, 20 references)

V. Tabone.

7

CONJUNCTIVA, CORNEA, SCLERA

Agarwal, L. P., and Malhoutra, R. L. **Conjunctival smear cytology in xerosis.** Ophthalmologica **130**:378-386, Dec., 1955.

The cytologic findings in conjunctival smears from normal individuals (in India) are reviewed. Of the epithelial cells 45 percent are cylindric, 45 percent polyhedral and 10 percent goblet cells. In females between 15 and 45 years of age, cytologic changes paralleling the menstrual cycle can be observed. In xerosis the number of goblet cells diminishes, all nuclei become reduced in size, the cytoplasm turns acidophilic and keratinization comes to the fore. Slight degrees of xerosis may be made to disappear clinically and cytologically by the intramuscular administration of 400,000 units of vitamin A once a week. Marked xerosis accompanying trachoma usually fails to respond to vitamin A therapy although the patient's dark-adaptation may improve. (5 figures, 2 tables, 5 references)

Peter C. Kronfeld.

Amsler, Marc. **The treatment of keratoconus.** Ann. d'ocul. **189**:129-136, Jan., 1956.

First degree keratoconus requires no treatment other than the prescription of a simple cylindrical lens whose axis and strength can be determined by the ophthalmometer. Second degree keratoconus requires a stronger cylinder, but here choice of axis and strength must be empiric since neither retinoscopy nor ophthalmometry help. Placido's disc may assist in determining the axis. Third degree keratoconus can only be corrected with contact lenses, and fourth degree keratoconus is generally treated by partial penetrating keratoplasty. The author most often employs a 7 mm. graft, slightly decentered downwards or downwards and temporally. (2 figures, 24 references)

John C. Locke.

Barkhash, S. **Partial penetrating and nearly complete corneal transplantation in children.** Vestnik oftal. **34**:16-24 May-June, 1955.

During the last few years corneal transplantations were performed on children at the pediatric clinic of Filatov's Ukrainian Experimental Institute of Eye Diseases. The author stresses the importance of restoring the vision in children for better general development and for the prevention of amblyopia. 186 eyes in 176 children were operated on. Of these, 38 were up to 6 years of age, 82, 6 to 12, and 56, 12 to 15 years; 126 children had thick leucomas and 89 had only light perception in both eyes; in 21, the vision in the bet-

ter eye was less than 0.1. Measles, trauma, scrophulosis were the cause of blindness in most of the children less than five years of age.

In partial penetrating corneal transplantation (diameter of transplant less than 7 mm.) a conjunctival flap was used. In nearly total transplantation (diameter over 7 mm.) corneal sutures were used. The small children were kept under light sedatives the first few days after the operation.

The anterior chamber was not restored in 17 children. This led to iritis or uveitis in 14 cases. Glaucoma was observed in 22 eyes which in many was the result of synechias in flat anterior chambers and in iridocyclitis. A frequent complication in nearly total transplantations was erosion of the transplant.

The optical results in 97 operations with staphylomas of the cornea were poor; still Barkhash believes that these eyes should be operated on for cosmetic reasons and for relief of the irritation of the eye because of the staphyloma (instead of enucleating them). The nearly total transplantation in these hopeless eyes with an opaque transplant can be improved later on by a partial penetrating keratoplasty. In two such eyes the vision was increased from light perception to 0.4.

These children were observed from one to five years. Some of them were transferred from schools for the blind into normal schools, and a few of them entered college. (3 tables, 6 figures)

Olga Sitchevska.

Bushmich, D. **The incompatibility of the tissues in keratoplasty.** Vestnik oftal. **34**:24-28, May-June, 1955.

The literature on the causes of the opacification of the transplant is reviewed. Bushmich recognizes four types of process which may take place. 1. The transplant is transparent because there is no reaction on the part of the recipient and the transplant. 2. There is a reaction of the eye of the recipient, but the transplant remains transparent. 3. There is a reaction of both the recipient and the transplant because of various factors such as late restoration of the anterior chamber, inflammatory processes in both corneal segments and in the uveal tract, and glaucoma. 4. There is no reaction during the first two to three weeks after keratoplasty but later changes occur in the transplant with a marked reaction on the part of the eye of the recipient and after the reaction subsides the transplant remains opaque.

Analysis of 418 partial penetrating keratoplasties showed that in 97 patients the process was of the fourth type. The transplant was transparent for three weeks, then the irritation of the eye would appear with a slight opacification of the transplant which usually progressed until, in the sixth or seventh week, the transplant was completely opaque and responded to no treatment.

Olga Sitchevska.

Kuwabara, Y., Uyemura, Y., and Miyashita, T. **Experimental keratoplasty with use of acrylic corneal implant.** Acta Soc. Ophth. Japan **60**:11-14, Jan., 1956.

In rabbits a direct implantation into the cornea of an artificial disc made of acrylic resin was not successful. However, an implantation into the sclera was successful. The authors then removed the resin disc successfully implanted into the sclera with scleral margins and implanted it into the cornea. The final result is not encouraging; the disc did not remain in the cornea more than 80 days. (11 figures)

Yukihiko Mitsui.

Vannini, A., and Pettinati, S. **Plesiotherapy in herpetic affections of the cornea.** Rassegna. ital. d'ottal. **24**:391-399, Sept.-Oct., 1955.

The application of X-rays to the cornea has given excellent results in the hands of the writers and of those quoted in the article. The inflammatory reaction of the anterior segment subsides rapidly, is not followed by desquamation of the epithelium, and recurrences of the corneal lesions are rare. While the exact technique is not detailed, apparently the radiation is applied at a short distance from the cornea. Beta radiation was employed in some patients with good result. It is suggested that the treatment excites an antivirus property in the cells surrounding the herpetic lesion. (1 table, 14 references) Eugene M. Blake.

Vejdovsky, V., and Mazanec, K. **Histologic findings after successful keratoplasty.** Ophthalmologica **130**:344-353, Nov., 1955.

A 60-year-old deaf mute patient died accidentally nine months after a successful, partial (4 mm.), penetrating keratoplasty. On histologic examination of the operated eye the graft was found to show all the characteristics of normal corneal tissue. (10 figures, 7 references)
Peter C. Kronfeld.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Agarwal, L. P., Jindal, K. S., and Saxena, R. P. **Role of aqueous humor cytopathology in differential diagnosis of iridocyclitis.** Ophthalmologica **130**:272-282, Oct., 1955.

Aqueous samples were examined for their protein, bacterial and cell content in cases of anterior uveitis in man as well as in experimentally produced uveitis in rabbits. In some instances the laboratory findings were distinctly helpful. The clinical impression of lens-induced uveitis was supported by the prevalence of eosinophiles, ciliary epithelium and corneal endothelium in the aqueous smear. In only one out of 15 cases of acute iritis was a microorganism (staphylococcus albus) identified by smear and culture. The dark-field technique revealed the presence of treponema pallidum in four out of six cases in which the uveitis, on clinical and serological grounds, had been assumed to be of syphilitic etiology. Similarly, the lepra bacillus was identified in aqueous smears from cases of leprous iritis. These smears also showed pronounced degenerative changes of the corneal endothelium. The authors have found cytologic and bacteriologic aqueous studies of sufficient clinical value to warrant their continuation and wider adoption. (7 figures, 17 references) Peter C. Kronfeld.

Akiya, S. **Cholesterosis of anterior chamber, report of two cases.** Acta Soc. Ophth. Japan **60**:5-11, Jan., 1956.

Histologic study of two eyes is reported. Cholesterol crystals were found in the vitreous as well as in the anterior chamber in both eyes. The retina was detached and there was granulation tissue filled with cholesterol. The granulation tissue was surrounded by foreign body giant cells. In one case such a granulation was found in the iris also. (2 figures, 28 references) Yukihiko Mitsui.

Flocks, M., Gerende, J. H., and Zimmerman, L. E. **The size and shape of malignant melanomas of the choroid and ciliary body in relation to prognosis and histologic characteristics.** Tr. Am. Acad. Ophth. **59**:740-758, Nov.-Dec., 1955.

The basis of this paper is a result of the study of 1064 melanomas reported by Wilder and Paul. A selected group of 210 cases showed that the larger the tumor, the worse the prognosis. According to the authors, the critical size of a malignant melanoma is one the volume of which is over 1300 cu. mm. Cell type is the single most important prognostic factor.

The authors' studies show that Bruch's membrane is more easily ruptured in older

persons than in younger persons. They also point out that in small atypical pigmented intraocular lesions, it is well to postpone enucleation until the clinical diagnosis of malignant melanoma seems established. (4 graphs, 10 tables, 14 references) Theodore M. Shapira.

Lepri, Giuseppe. **Posttraumatic atypical iris node.** Ophthalmologica **130**:412-416, Dec., 1955.

A 20-year-old female patient sustained a stab wound of sclera and ciliary body of the left eye, in the 5-o'clock position 2 mm. from the limbus. The wound healed without complication, particularly without intraocular hemorrhage. The vision returned to normal. Subsequently the patient was reexamined every six months for two years without any change in the objective appearance; 2½ years after the injury the patient returned because she had noticed a white tissue in her eye. A white nodule loosely attached to the iris was found in the anterior chamber of the very slightly congested eye. During the surgical removal the nodule crumbled; the fragments showed only collagenous fibrils. During a postoperative observation period of six months the eye has remained quiet and free of visible recurrences. (2 figures) Peter C. Kronfeld.

Nano, H. M., and Gilabert, N. **Harada's disease. Report of a case treated with ACTH.** Arch. oftal. Buenos Aires **30**:411-420, Oct., 1955.

A 26-year-old man with all the classic signs of severe subacute Harada's disease responded dramatically to the systemic administration of low doses of ACTH given at 12 to 24 hour intervals for a period of several weeks. Vision, which at the start was reduced to the ability of counting fingers at a distance of a few feet, reached the 20/20 level at the end of two months. Functional recovery was accompanied by a nearly complete subsidence of the ophthalmoscopic changes. (3 figures, 51 references) A. Urrets-Zavalia, Jr.

Redslob, E. **Research into the pathogenesis of sympathetic ophthalmia.** Ann. d'ocul. **189**:53-64, Jan., 1956.

The author reviews the studies that have been carried out to determine the pathogenesis of sympathetic ophthalmia, since this disease was first described in 1583, and he briefly discusses the various theories that have been proposed. (72 references) John C. Locke.

Shubova, T. **Neurofibromatosis of the iris.** Vestnik oftal. **34**:30-32, Sept.-Oct., 1955.

A woman, aged 29 years, had general neurofibromatosis (von Recklinghausen's disease. There were multiple nodules on the skin of the back, arms, legs and face and a great number of very small, round grayish-brown nodules in the iris of each eye. The visual fields were normal. The X-ray studies of the skull showed thinning of the back of the cella turcica. (1 figure) Olga Sitchevska.

9

GLAUCOMA AND OCULAR TENSION

Aguilar Munoz, J., del Rio Cabanas, J. L., and Calvo Pico, J. L. **The therapeutic use of diamox in ocular hypertension.** Arch. Soc. oftal. hispano.-am. **15**: 1229-1239, Nov., 1955.

Nine cases of various types of glaucoma treated with diamox are briefly reported, and the action of the drug in these cases is shown graphically. The dosage used consisted of 750 mg. daily, two 250 mg. tablets administered in the morning and one in the evening. In two cases of absolute glaucoma and in one of simple glaucoma the tension was reduced to limits which made surgical intervention safe. In one case of acute glaucoma the effect of diamox was surprizing; in the right eye

tension was reduced from 32 to 24 mm. Hg; in the left eye, which was the better seeing eye, the tension rose from 32 to 55 mm. Hg. In a case of infantile glaucoma in a four-year-old child, the diamox reduced the tension from 60 to 18 mm. Hg, but the drug caused symptoms of hepatic insufficiency, and had to be discontinued, whereupon the ocular tension, uncontrolled by miotics, rose again. The author believes that the intolerance to the drug may have been caused by excessive dosage, which was 75 mg. daily. In two cases of secondary glaucoma, one after operation for cataract and the other after uveitis, the tension was controlled with diamox. In two cases of cataract and glaucoma tension was reduced sufficiently to permit uneventful cataract extraction; however, one patient developed a hemorrhagic glaucoma four days after the operation. This leads the author to conclude that while diamox does place the eye in optimum conditions for surgery, in case of cataract and glaucoma an antiglaucoma operation should precede the cataract extraction. (9 graphs) Ray K. Daily.

Bailliart, P. **Reflections on glaucoma.** Ann. d'ocul. **189**:19-26, Jan., 1956.

The author reviews some current concepts of the pathogenesis of chronic simple glaucoma. He emphasizes that only by studying the patient as a whole will the problem ultimately be solved. (14 references) John C. Locke.

Gafner, F., and Goldmann, H. **Experimental studies of the relationship between elevated intraocular pressure and visual field damage.** Ophthalmologica **130**:357-377, Dec., 1955.

This study consists essentially of three parts. Part one concerns itself with this question: Can visual field changes, analogous to those occurring in simple glaucoma, be produced in the normal human by raising the intraocular pressure artificially? In a previous communication (cfr. Am. J. Ophth. 39:443, 1955) the authors described the method of skiascotometry and its value for the detection of early glaucomatous field changes. In principle, skiascotometry consists of measuring the length of time (skiascotoma—time of SST) during which a white target moving through the visual field at a certain speed is rendered invisible to the examinee by a shadow-producing object. In the normal visual field SST increases steadily with increasing eccentricity of the target. In very early glaucomas the authors found a characteristic hump, that is prolongation of SST in the zone 10-20° from the point of fixation. External pressure exerted on normal eyes during the skiascotometric test also produced prolongation of the SST with a hump in 10-20° zone. The rise in pressure necessary to produce a barely demonstrable prolongation of the SST was found to be directly related to the prevailing blood pressure in the retinal arterioles, higher external pressure being necessary in eyes with higher arterial pressure and vice versa.

The second part of the study concerned itself with the effects upon SST of partial anoxia and of venous stasis by neck compression in normal controls. Definite prolongation of the SST without a hump in the 10 to 20° zone was found under the influence of both experimental procedures.

The third part of the study is an analysis of the hemadynamics in the region of the lamina cribrosa in the light of François' recent findings concerning the arterial supply of the optic nerve. This analysis makes it highly probable that a rise in intraocular pressure reduces the blood flow through the vessels serving the lamina by a larger percentage than in any other arteries of the globe.

In their conclusion the authors stress the rough and diagrammatic nature of the mechanisms reviewed here. The actual relationship between elevation of intra-

ocular pressure and optic nerve damage is probably complicated by biologic regulatory and other physical mechanisms. (8 figures, 2 tables, 31 references)

Peter C. Kronfeld.

Gramberg-Danielsen, B. **Treatment of glaucoma with chlorpromazine.** Ophthalmologica **130**:403-412, Dec., 1955.

In a series of 30 cases of glaucoma, mostly of the primary, acute angle-closure variety, the author has observed a fairly consistent rapid drop in ocular tension and in blood pressure immediately following the slow intravenous injection of 50 mg. of chlorpromazine. Continued administration of the drug by mouth usually fails to maintain the ocular tension within normal limits, but the initial, at times dramatic, drop may be of practical value. The pressure of the normal eye is not affected by either intravenous or the oral administration of the drug. Its site of action is assumed to be the hypothalamic, pressure-regulating center. (2 figures, 38 references) Peter C. Kronfeld.

Kalfa, S., and Paramonov, A. **The change of sensitivity in the area of the first and second branch of the trigeminus nerve in glaucoma.** Vestnik oftal. **34**:33-37, May-June, 1955.

The sensitivity of the cornea of 54 eyes was studied by touching with a hair at 17 points; 42 of the eyes had congestive glaucoma in various stages, four had chronic simple glaucoma and eight were questionable. The sensitivity of the cornea was reduced in 34 of 54 eyes; it was absent in 9 of 10 eyes in absolute glaucoma.

There was a relationship between the degree of increase in ocular tension and the spreading of pain in the area innervated by the first branch of the trigeminal nerve. The second branch was not involved. There was no change of sensitivity of the skin in chronic simple glaucoma. The disturbance of the sensitivity of the cornea is an early sign in glaucoma and is an indicator of the beginning of trophic disturbance of the eye. (2 tables)

Olga Sitchevska.

Kerdman, P. **The condition of the nervous activity in glaucoma.** Vestnik oftal. **34**:6-12, Nov.-Dec., 1955.

The conditioned reflexes were judged by the rapidity of response to white and blue lights (the method of Ivanov-Smolensky). The nonconditioned reflexes were studied with the aid of the plethysmograph. 50 glaucomatous patients were tested; 23 had chronic inflammatory, 10 absolute, and 17 chronic simple glaucoma. The duration of the disease was from one to 15 years. In 35 patients various anti-glaucoma operations were performed. The vision, visual fields, intraocular and arterial pressure were taken in all patients. The analysis of this material indicates that in the chronic inflammatory glaucoma (even in the initial stage), in very nervous subjects, a wavy, or the inert type of the plethysmographic curve is observed, while in simple glaucoma it is observed only in the very advanced stage of the disease. Olga Sitchevska.

Paufique, L. **Congenital glaucoma. Associated clinical manifestations and therapeutic indications.** Ann. d'ocul. **189**:27-36, Jan., 1956.

Of 15 patients with congenital glaucoma, four had albumen, casts and an excess of amino acids in the urine, confirming the association of congenital glaucoma with a particular type of nephropathy, as described by Lowe, Terrey and Maclachlan in 1952.

In Stage I of congenital glaucoma, the cornea is clear. Gonioscopy permits differentiation from megalocornea, and also allows goniotomy to be carried out under direct observation. Goniotomy, as described by Barkan, is the operation of

choice and is successful in 80 percent of cases.

In Stage II, the cornea is no longer clear, but Schlemm's canal is patent. Goniotomy remains the operation of choice, but the results are less consistent. Conditions are also less favorable, because the operation can no longer be carried out under direct observation because of the hazy cornea. Diamox may occasionally reduce the tension sufficiently to clear the cornea. Repeated goniotomies may have to be done. These are without danger and if they fail, other operations can still be done.

In Stage III, the canal of Schlemm is no longer patent, and goniotomy will not only fail but will also be dangerous, because in this stage neovascularization may occur in the angle and lead to a massive hemorrhage in the anterior chamber. Nonperforating retrociliary diathermy in the two upper quadrants, combined with cyclodialysis in one of the lower quadrants is recommended. Iridencleisis may also give good results, but is a more dangerous operation. The imprecise location of the limbus in these large buphthalmic eyes makes it more difficult. Diathermy coagulation of the long posterior ciliary arteries is being investigated with promising results so far. It appears to be no more dangerous than cyclodiathermy and may prove to have a greater tension-lowering effect. John C. Locke.

Pletheva, N., Baulina, N., and Beslakov, T. **The influence of partial removal of the cortex of the hemisphere on the intraocular pressure.** Vestnik oftal. **34**: 3-8, Sept.-Oct., 1955.

Experiments were done on four rabbits. The ocular tension was measured and elastotonometry was repeatedly done before and after operation. Unilateral and bilateral excision of cerebral cortex was done. The first rabbit died three hours after the first operation. The others were killed from 6 to 12 weeks after the second operation. The postmortem examination of the brain revealed the location and depth of the lesion. The postoperative observations and findings are described in great detail. The authors came to the following conclusions. 1. The cortex of the brain takes part in the conditioned reflex which regulates the intraocular pressure. 2. Unilateral partial removal of the cortex causes more severe changes in ocular tension, in the elasto-tonometric curve and the reactive hypertony than bilateral removal of the cortex. 3. A long time after partial bilateral decorticozation, the intraocular tension and the elasto-tonometric curve eventually become more or less normal. This can be explained by the functional compensatory ability of the remaining tissue of the cortex and the centers of the nervous system situated below. 4. The cortex has no definite center which regulates the intraocular pressure. 5. The reactive hypertony of the eye is a defense reaction. (3 figures)

Olga Sitchevska.

Radnot, M. **The intraocular pressure in cases of tumors of the hypophyseal region.** Ophthalmologica **130**:209-212, Sept., 1955.

In a 68-year-old man symptoms of a pituitary lesion, namely, bitemporal field defects, destruction of the sella, optic atrophy and hypogenitalism, were associated with instability of the ocular tension (up to 35 mm. during one period and down to 13 mm. during another period) and marginal excavations of both discs. The author's interpretation of the case is that of a chromophobe adenoma with fluctuations of the ocular tension of central, hypothalamic origin. (3 figures, 9 references) Peter C. Kronfeld.

Radovici. **Corticothalamic factors in the pathogenesis of glaucoma. Excursion of a**

neuropsychiatrist into the domain of ophthalmology. Ann. d'ocul. **188**:881-903, Oct., 1955.

The central nervous system plays an important role in the pathogenesis of primary glaucoma, which, like idiopathic epilepsy, is a reaction to stress. Miotics and surgery normalize intraocular pressure, but do not halt progress of the disease. In chronic simple glaucoma, barbiturates and diencephalic sedatives should also be given. Neuropsychiatric examination is indicated to resolve psychic conflicts. The patient may need to change his work or his entire way of life. He should live quietly, preferably away from larger centers, and should avoid people who irritate him. Stimulants, including coffee, should be controlled. In acute glaucoma, administration of a general anesthetic (preferably by the intravenous route), followed by the retrobulbar injection of 60 percent alcohol, will usually control the attack and change the condition into the chronic form, making surgical intervention unnecessary. John C. Locke.

Redslob, E. **The histopathology of primary glaucoma.** Ann. d'ocul. **188**:782-826, Sept., 1955.

The histopathology of primary glaucoma is reviewed. (8 figures; 113 references) John C. Locke.

Rizzini, Vittorio. **Effects of "sleep therapy" and serpasil on tension.** Gior. ital. oftal. **8**:454-456, Sept.-Oct., 1955.

Drugs used in the production of sleep for therapeutic purposes, as well as serpasil, reduced ocular tension. Their effect on the pupil was equivocal and there was no noticeable effect on the retinal circulation. (2 tables) V. Tabone.

Schenk, H., and Eberhartinger, W. **The effect of blood pressure-lowering drugs upon the intraocular pressure.** Ophthalmologica **130**:312-320, Nov., 1955.

The ganglionic blocking agents hexapressin and pendiomide, administered retrobulbarly or intramuscularly to a small group of patients with advanced primary or secondary glaucoma, caused more or less parallel drops in blood pressure and intraocular pressure. In one case the effect of hexapressin was compared with that of apresoline. The blood pressure dropped under the influence of both drugs; the ocular tension dropped after hexapressin and rose after apresoline. The authors are inclined to attribute the ocular tension-lowering effect of the ganglionic blocking agents to a lowered rate of aqueous secretion. (11 tables, 19 references)

Peter C. Kronfeld.

Schmitz, E., and zu Salm-Salm, E. **Comparative observations of the relationship between calcification of the carotid artery, glaucoma and so-called pseudoglaucoma.** Arch. f. Ophth. **156**:303-312, 1955.

The incidence of radiologically demonstrable calcification of the carotid artery was found to rise gradually from the fortieth to the sixtieth year of age when it became 50 percent. The distribution of glaucoma was similar. The influence of the vascular change on the development of binasal defects in the fields is statistically demonstrable with certainty, but the development of excavation of the disc is only a probability. Visual acuity, tension and total field are not influenced. Roentgenographic demonstration of calcification of the carotid does not justify any diagnostic conclusions regarding injury to the optic nerve. (9 tables, 33 references)

F. H. Haessler.

Talkowsky, S., Shartz, S., and Bochever, E. **Antihistaminic therapy for pain in glaucoma.** Vestnik oftal. **34**:36-38, Nov.-Dec., 1955.

Dimedrol (Benadryl) in a 1-percent aqueous solution was given by conjunc-

tival instillation three to five times daily for six to seven days in 125 patients with glaucoma; 35 of these patients had decompensated simple glaucoma, 25 had chronic inflammatory, 13 secondary, and 52 painful absolute glaucoma. The pain was reduced in all but 25 patients. Neither the intraocular pressure nor the size of the pupils was affected by the drops. There was lowering of the sensitivity of the cornea in the 47 patients who were tested, which indicates that dimedrol has an anesthetic effect. Dimedrol also was given by mouth, but its effect was of short duration. Olga Sitchevska.

Vannini, Angelo. **Histologic study of an eye removed ten days after an iridencleisis operation.** Rassegna. ital. d'ottal. **24**:363-370, Sept.-Oct., 1955.

The eye described was injured 30 years previously. Later cataract developed which was extracted and finally the eye was subjected to an iris inclusion operation. Because of intense pain, enucleation was performed 10 days postoperatively. The histologic changes are carefully described and well illustrated. The author advises against the use of cortisone immediately after glaucoma surgery. (6 figures, 4 references) Eugene M. Blake.

Weekers, R., Watillon, M., and de Dudder, M. **Limits of normal intraocular pressure.** Ann. d'ocul. **188**:920-926, Oct., 1955.

To increase the accuracy of measurements of ocular tension and to reduce the range of values considered normal, tonometers should conform to the requirements of the current American standards. Also, the 1954 Schiøtz table of the American Academy of Ophthalmology and Otolaryngology should be employed universally. Under these conditions, normal ocular tension varies from 10 to 22 mm. Hg, but is generally 15 to 16.5 mm. Hg. (1 graph, 3 tables) John C. Locke.

10

CRYSTALLINE LENS

Aguilar Munoz, J. **Late metastatic infection of a sclerocorneal cicatrix after cataract extraction.** Arch. Soc. oftal. hispano.-am. **15**:1131-1134, Oct., 1955.

Simultaneously with acute tonsillitis, a woman, 70 years old, developed a purulent infection in the upper portion of the wound, 22 days following an uneventful cataract extraction. The infection of the throat and eye subsided at the same time with intense antibiotic therapy. The patient had two other similar attacks of tonsillitis and wound infection, controlled in a similar manner. The attacks ceased when the offending tonsillar area was coagulated. The final result was recovery of the eye, and a visual acuity of 2/10 with an astigmatism of 14 diopters. The author considers this a metastatic infection in an area of low resistance. (2 figures) Ray K. Daily.

Barraquer Moner, Joaquin. **Our first case of inclusion of Strampelli's plastic lens in the anterior chamber.** Arch. Soc. oftal. hispano-am. **15**:1321-1325, Dec., 1955.

The Strampelli lens is described. In the first case, done by the author, a secondary glaucoma developed because of a pupil block, which was controlled by a retrociliary cyclodiathermy. The author believes that after the lens is inserted into the anterior chamber a peripheral iridectomy should be done in the 12-o'clock position. (6 figures, 2 references)

Ray K. Daily.

Dunnington, John H. **Hypotony after cataract operation.** Brit. J. Ophth. **40**:30-35, Jan., 1956.

At times the limbal wound fails to heal properly and leakage continues and then serious sequellae may result. This complication can occur as a constant though

short-lived leakage or may remain a latent, intermittent and serious complication. In the cases in which there is constant leaking soon after surgery, the anterior chamber may be quite shallow, some vitreous may be pushed forward and even touch the cornea. Ordinarily this lasts for four or five days and then heals spontaneously. If it persists longer than that, glaucoma is very likely to develop with scarring of the cornea. In intermittent leakage of the anterior chamber, the eye seems to heal normally but several months later, irritation and intermittent hypotony begin to occur and may be followed by uveitis and eventual loss of the eye. This is the result of very small defects of the section which heal intermittently and break open again over long periods. The sites of the tiny openings are very difficult to find but can be found at times with a type of fluorescein test under pressure.

Treatment of the first type consists of conservative waiting followed by surgical closure of the leaking wound plus evacuation of the subchoroidal fluid. Therapy of the intermittent type involves finding the area of drainage and closing it surgically, and cauterization of the area. (20 references) Morris Kaplan.

François, J., and Beheyt, J. **The prevention of X-ray cataract by cysteamine.** Ophthalmologica **130**:397-402, Dec., 1955.

Von Sallmann and his associates had shown that one large dose of cysteine administered intravenously protected rabbits against ordinarily cataractogenic doses of X-rays. Bacq and his associates found cysteamine (beta-mercapto-ethylamine) to be an even more effective radioprotective agent. The authors of the paper under review exposed rabbits to 1500 to 2500 r, with and without previous administration of cysteamine. Only if administered intravenously before the exposure did the sulfhydryl compound have any protective effect. With the dosages used the radio-dermatitis and conjunctivitis were inhibited or prevented to a greater extent than the cataract. (2 tables, 8 references) Peter C. Kronfeld.

Fuentes Noya, M. **Cataract extraction. Complicated cataract. A new needle holder.** Arch. Soc. oftal. hispano-am. **15**: 1311-1320, Dec., 1955.

When the suction apparatus failed to function in the course of a cataract extraction, the author attached the Barraquer suction tip to a piece of rubber, and extracted the lens by mouth suction. Having found the procedure surprisingly effective he now uses mouth suction routinely. He describes a needle holder for the Grieshaber needles made in a design similar to de Wecker iris scissors. In addition to the case in which he used mouth suction as an emergency procedure, he reports two cases of successfully extracted complicated cataract. One was a case of bilateral recurrent iridocyclitis with extensive synechia: after the keratotomy a peripheral iridotomy was done, and a spatula introduced behind the iris through this opening. After the synechia were separated the iridotomy was converted into a complete iridectomy, two sphincterotomies were made below and the lens delivered. The patient recovered a visual acuity of 1/3. The patient had no further attacks of iridocyclitis in either eye. The second case was that of intumescent cataract with glaucoma. After the keratotomy the author did a reverse cyclodialysis above. After the bleeding was stopped an iridectomy was done and the lens delivered. Both eyes were operated upon in this manner with the recovery of normal central visual acuity and of normal tension. (7 figures) Ray K. Daily.

Rizzini, Vittorio. **Traumatic subluxation of Soemmering's ring.** Gior. ital. oftal. **8**:505-509, Nov.-Dec., 1955.

A case is described of traumatic dislocation of Soemmering's ring in a myopic eye with retinal detachment. The 11 published cases are reviewed. (1 figure, 9 references) V. Tabone.

11
RETINA AND VITREOUS

Beiras, Antonio. **A preretinal cyst.** Arch. Soc. oftal. hispano-am. **15**:1276-1277, Nov., 1955.

The author reports a case of a preretinal cyst in the right eye of a patient with retinosis pigmentosa. The nature of the cyst has not been established, and it has not undergone any significant changes during a ten-year period of observation. (2 figures) Ray K. Daily.

Colenbrander, M. C. **How can administration of oxygen give rise to anoxemia?** Ophthalmologica **130**:220-223, Sept., 1955.

The salient point in Colenbrander's theory of retrolental fibroplasia is that normal tissue metabolism requires rhythmic variations of the capillary blood pressure. These variations which, in the normal infant, are brought about by oxygen-sensitive receptors in the carotid sinus, are inhibited by constant high oxygen concentrations such as are the result of steady supplementary oxygen administration. Colenbrander, therefore, recommends rhythmic oxygen administration, such as 1 liter per minute for ½ hour alternating with no supplementary oxygen for ½ hour. This form of treatment seemed to be effective in the one case in which it was tried. Peter C. Kronfeld.

Dobree, J. H. **Calibre changes in retinal vessels occurring in raised ocular tension.** Brit. J. Ophth. **40**:1-13, Jan., 1956.

In this study photographs were made of changes in caliber of retinal vessels in cases of chronic simple glaucoma during periods of high tension and of lowered tension brought about both medically and surgically. Only eyes without congestion were used; 13 eyes of 12 patients were selected. They were divided into four different groups according to the height of the ocular tension and frequent photographs under identical conditions were made before and after treatment. Changes in vessels were very definite and directly proportional to the height of the tension. In eyes with much elevation of tension there was a marked dilatation of both arteries and veins. (1 figure, 5 tables, 26 references) Morris Kaplan.

Frey, R. G. **Bilateral idiopathic retinal detachment with symmetrical disinsertion in juveniles.** Klin. Monatsbl. f. Augenh. **128**:50-57, 1956.

Two patients with the lesion which is described in the title were seen at the II University Clinic in Vienna during the last ten years. Both boys were 13 years old and regained vision after operations (diathermy). The end results were good and the simultaneous occurrence of the detachment in both eyes was probably due to the extensive cystoid degeneration of the retinal periphery.

The author differentiates this type of disinsertion from the true oral tear as does Hruby. The latter occurs in highly myopic eyes, the vitreous remains attached to the peripheral margin of the tear and the prognosis is poor. The former is combined with a vitreous detachment from the ora, occurs in nonmyopic eyes and has a good prognosis. (6 figures, 23 references) Frederick C. Boldi.

Funder, Wolfgang. **Retinal detachment in the aphacic eye.** Arch. f. Ophth. **157**: 40-50, 51-61, 62-71, 1955.

The three papers deal with: 1. the types of cataracts involved, 2. the clinical picture of retinal detachment following surgery for cataract, and 3. prognosis with respect to the detached retina and surgery for it. The author reports 89 cases of his own and for comparison about 1,100

case histories. He found: 1. the increase in longevity of the population seems to be accompanied by a proportionate increase in retinal detachments in aphakia. Many detachments had occurred where the cataracts had been operated upon in younger years of the patients. Discissions for juvenile cataracts may favor retinal detachment. Complications due to myopia or involvement of the vitreous body seem to promote retinal detachment. 2. Retinal detachment in aphakia was seen more often in men than women. It occurred earlier post operationem in older than in younger persons, and sometimes both eyes were affected. 3. Prognosis with respect to retinal detachment following surgery for cataract seems to be less favorable than otherwise. Closure of the retinal rupture together with shortening of the bulbus is considered the operation of choice. (3 figures, 26 tables, 42 references) Ernst Schmerl.

Handl, O. **Treatment of retinal angiomatosis.** Klin. Monatsbl. f. Augenh. **128**: 62-70, 1956.

Handl describes three young patients with von Hippel's disease. All were improved with electrocoagulation. One eye had previously been treated with radium without success. In one instance a scleral resection had to be done first so that the detachment decreased and the angiomatous nodule then became visible. (3 figures, 24 references)

Frederick C. Blodi.

Hashimoto, T. **Clinical studies of electroretinogram. III-IV.** Acta. Soc. Ophth. Japan **60**:151-157, and 198-204, March-April, 1956.

This is a study of the ERG by spectrum light stimuli in normal and color blind individuals. The height of the b-wave of the ERG is comparatively studied by changing the wave length of the stimulating light. In light-adapted normal eyes, the highest b-wave of the ERG is obtained by a stimulus with a light of 510 mμ wave length. Another slight elevation of the b-wave is also observed by a light of 560 mμ. In dark-adapted normal eyes, the highest b-wave is obtained only by a light of 490 mμ. Hashimoto believes that the peak by the light of 490-510 mμ is related to the sensitivity of the cones and that by the light of 560 mμ to the sensitivity of the rods. Among color blindness, only the light-adapted subject with protanopsia showed a different characteristic, the absence of the elevation of b-wave by the light of 560 mμ. (13 figures, 32 references) Yukihiko Mitsui.

van den Heuvel, J. E. A. **Precipitates on the vetreous.** Ophthalmologica **130**: 191-200, Sept., 1955.

In the course of a granulomatous chorioretinitis a large number of precipitates could be observed on the posterior (retinal) surface of the partly detached vitreous. (4 figures, 14 references)

Peter C. Kronfeld.

Huerkamp, B., and Behme, H. **The range of ocular tension in retinal detachment with a tear in the ora.** Arch. f. Ophth. **156**:433-442, 1955.

The tension in 221 eyes with retinal detachment with a tear was compared with that in 847 without tears and the higher incidence of increased tension in eyes with tears was striking. This increased tension is shown to be secondary glaucoma and it is characterized by an inverse diurnal variation; mydriatics do not cause an increase in the tension and after successful surgery for detachment, it disappears. The increase in tension is ascribed to irritation of the ciliary body. (4 figures, 2 tables, 25 references)

F. H. Haessler.

Humblet, M., Cavrot, E., and Richard, J. **Retinal hemorrhages in full-term new-**

born infants. Bull. Soc. belge d'opht. **110**: 137-141, June, 1955.

Ophthalmoscopic examination of 421 normal, new-born infants during the first 48 hours of their life showed that the incidence of retinal hemorrhage depended on the type of delivery and that for the same type of delivery preventive treatment diminished the incidence and severity of retinal hemorrhages. The treatment of choice consisted of 10mg. vitamin K, given twice a day during the last four weeks of pregnancy or preferably longer. (4 tables) Alice R. Deutsch.

Janssens, G. J. A. **Results of globe shortening by reefing of the sclera.** Ophthalmologica **130**:227-228, Sept., 1955.

Weve's reefing or tucking of the sclera is a form of infolding by suitably placed sutures (cfr. Am. J. Ophth. 33:1969, 1950). The present report concerns itself with the cases of retinal detachment operated upon by this method at Weve's clinic in Utrecht during 1953. The specific indications for reefing were: starfolds, preretinal membranes or strands, giant holes, tears or rents at the posterior border of chorioretinal scars after electrocoagulation, and extreme scarring after previous coagulation without visible holes.

Observing these indications, 51 cases of retinal detachment were operated upon by the reefing method during 1953. In 80 percent of these cases another type of detachment operation had failed prior to the reefing. The operation was performed once in 37 cases, twice in nine cases, three times in three cases and four times in two cases.

The reefing resulted in complete reattachment in 23 cases (45 percent) and in partial reattachment, that is improvement, in another eight cases.

Peter C. Kronfeld.

Kabakow, B., van Weimokly, S. S., and Lyons, H. A. **Bilateral central artery occlusion.** A.M.A. Arch. Ophth. **54**:670-676, Nov., 1955.

A patient with lupus erythematosus and bilateral occlusion of the central artery is reported. This complication of lupus erythematosus had not previously been reported, according to the authors. (41 references) G. S. Tyner.

Kornerup, Tore. **Studies in diabetic retinopathy; an investigation of 1000 cases of diabetes.** Acta Med. Scandinav. **153**:81-101, 1955.

A detailed series of tabulations is made of the findings in this large group of diabetics. They include distribution in regard to sex, age, duration, frequency, severity, the relationship of blood pressure changes, hypertensive retinopathy, proteinuria, and ketone bodies and acidosis. Hanum's classification is used, with assigned values for absent, hemorrhagic, exudative, and proliferative retinopathy. The distribution was interesting in that the condition was commoner in males before the age of 50 years, and in females after that age. Hypertensive retinopathy is a different disease from diabetic, but it and elevated blood pressure are commoner in diabetes with late onset. The frequency of diabetic retinopathy in this series was 46.8 percent, and in the study increased with the duration. The incidence of hypertensive retinopathy was independent of the duration of the diabetes. Thirty percent of those with retinopathy had proteinuria, but 76 percent of those with proteinuria had retinopathy. The retinopathy usually precedes proteinuria. No conclusions were reached concerning ketosis and acidosis. (1 graph, 30 tables, 43 references)

Harry Horwich.

Krasnov, M., Kritchewskaya, E., Shakhnowich, S., Shulpina, N., and Gelfman, A. **Dicumarin in the thrombo-embolic syndrome of the retinal vessels.** Vestnik oftal. 1:3-8, Jan.-Feb., 1956.

Dicumarin (dicumarol) was given to 50 patients with various affections of the reti-

nal vessels in 1953 to 1954. The prothrombin index was increased in 47 patients 112 to 280 percent. This indicates that the thrombo-embolic syndrome has a certain relation to the increased prothrombin index. The content of fibrin in the blood was also increased in 38 patients. This study showed that dicumarin lowered the prothrombin index and the content of fibrin in the blood. The arterial pressure was lowered and the general condition was improved with the administration of dicumarin.

Dicumarin was given to 35 patients, aged 40 to 70 years, with hypertension, of whom 16 had thrombosis of the central or branch of the retinal vein, 11 occlusion of the artery, 7 had spasm of the artery and one had hypertensive retinopathy. No dicumarin was given to 15 patients with identical lesions of the retinal vessels who served as a control.

In a number of patients treated with dicumarin, there was increased visual function, increased visual fields and an earlier absorption of the hemorrhages. The general condition was improved in many patients. Olga Stichevska.

Kronenberg, Bernard. **Diathermic surgery for a case of angiomatosis retinae.** A.M.A. Arch. Ophth. **55**:25-27, Jan., 1956.

Kronenberg adds one more case to the 150 cases previously reported in the literature. When combined with cerebellar cysts, the entity is known as Hippel-Lindau disease.

The author believes that patients should be treated in the early stages to prevent progression of the disease. Radiation has been the usual method of treatment, but lately diathermy has been used. In localizing the growth, the same technique can be used as that employed in localizing a tear.

Kronenberg describes his operative technique using surface coagulation and Walker pins. Two and one half years after surgery, this 36-year-old woman has 20/40 vision and the process seems arrested. (11 references) G. S. Tyner.

Landau, J., and Feinmesser, M. **Audiometric and vestibular examinations in retinitis pigmentosa.** Brit. J. Ophth. **40**:40-44, Jan., 1956.

The simultaneous occurrence of visual and acoustic lesions has been reported before; it is assumed that this phenomenon has a common point of origin in a mutated gene. In this study 22 patients with retinitis pigmentosa and four of their children were tested with the audiometer; 14 were affected and 9 showed a typical deafness of perception type. One patient was totally deaf, two showed deafness of mixed type and two of conduction type. The four children showed no audiometric irregularities. (3 figures, 1 table, 14 references) Morris Kaplan.

Lijo Pavia, J. and Lachman, R. **Retinitis exudativa interna.** Rev. oto-neuro-oftal. **30**:113-115, July-Aug., 1955.

The authors describe a young girl with retinitis exudativa interna, which healed spontaneously. Only vitamins had been given. The girl was seen again ten years after, when the visual acuity was 10/10 in each eye. Ophthalmoscopically, the affected eye only showed a small area of retinal atrophy. The authors emphasize the extreme rarity of this disease as compared with the retinitis exudativa externa and the almost complete lack of any description in the literature. (3 figures) Walter Mayer.

Lucas, D. R. **Retinitis pigmentosa.** Brit. J. Ophth. **40**:14-23, Jan., 1956.

Clinical and postmortem pathologic studies of the eyes of two patients with retinitis pigmentosa are described. In one of them inheritance was recessive, in the other dominant. In both cases the retina was relatively normal in the foveal area but markedly abnormal elsewhere. The visual cell layer was degenerated, the inner nu-

clear and ganglion cell layers were rather well preserved but patches of gliosis were found everywhere. There was much pigment invasion along the vessels and throughout the equatorial region. Marked sclerosis of the vessels was ascribed to age. In one the choroid was thickened with periarteritis, in the other the choroid was normal and in both the optic nerves were normal. The findings in these eyes and in all that have been reported are tabulated for comparison. (6 figures, 2 tables, 35 references) Morris Kaplan.

McNeil, N. L. **Some ocular manifestations of prematurity.** Brit. J. Ophth. **40**: 24-29, Jan., 1956.

The authors describe the fully developed end-stages of cicatrization in retrolental fibroplasia more fully than has been done before. Sixteen premature children at various ages are described most of whom had obvious retrolental fibroplasia and some who obviously did not. Myopia, in some cases quite severe, was present in 22 of the 32 eyes and seems to be a frequent result of prematurity. This myopia is not progressive and is a different entity from the usual myopia seen with a family history of the disease. Most of these children had retinal folds of various sizes, shapes and positions and some showed the resultant distortion of the disc. Most of the children had some type of nystagmus. (3 figures, 9 references)

Morris Kaplan.

Mylius, K., and Stark, H. **The significance of arteriosclerosis in foveal lesions.** Arch. f. Ophth. **156**:374-394, 1955.

The senile foveal lesion is often the result of progressive obliterating atherosclerosis in the choriocapillaris. Other clinical manifestations of the vascular process are often demonstrable and the resulting paper electrophoretic determinations of the blood lipoprotein spectrum support this concept of pathogenesis. Heparin is effective in changing this lipoid spectrum so that it approaches normal values and its clinical use has given encouraging results in about a dozen patients which are described in detail (1 figure, 12 references. F. H. Haessler.

Nesserov, A. **Detachment of retina in a glaucomatous eye.** Vestnik oftal. **34**:34, May-June, 1955.

A case of detachment of the retina in a 65-year-old woman with chronic simple glaucoma is reported. A diathermy operation was done, but 10 days later the patient had an acute attack of glaucoma, which was alleviated by means of conservative therapy. Six weeks later there was complete reattachment of the retina, the vision was 0.8, the field enlarged and the intraocular pressure normal. The increased tension in the eye may have been a factor in the attachment of the retina.

Olga Sitchevska.

Peterhans, August. **A statistical study of 426 cases of herpes corneae.** Ophthalmologica **130**:244-271, Oct., 1955.

The author's interest in some aspects of the herpes problem was aroused by a very unusual case of bilateral dentritic keratitis in a four-month-old infant in whom, at one time, dendritic infiltrates were present all over the surface of both corneas and cleared up fairly promptly after cauterization with iodine and complete removal of the epithelium.

The statistical study was made on 426 cases of herpetic keratitis observed and treated at the eye clinic of the University of Basle (Switzerland) between 1939 and 1949. Here are some of the findings. Men were more frequently affected than women. The disease involved the center and the lower sector of the cornea more frequently than any other portion. In about 10 percent of all the cases reviewed the keratitis followed in the wake of a systemic grippe-like, febrile disease. In 20

percent of the cases the keratitis was precipitated by a minor superficial corneal trauma. The probability of developing herpetic keratitis after such trauma was estimated to be 1 in 100. The principal effect of the treatment seemed to be shortening of the course of the disease. (4 figures, 43 references) Peter C. Kronfeld.

Planten, J. T. **Retrolental fibroplasia terminating in ablatio falciformis.** Ophthalmologica **130**:214-216, Sept., 1955.

A premature female infant, weighing 900 gm. at birth by Cesarean section, spent the first 37 days of her life in the incubator with supplementary oxygen measured in terms of flow rate but not of actual oxygen concentration. Because of marked improvement in her general condition she was then put on regular nursery care and examined ophthalmoscopically once a week. Three weeks later the first ophthalmoscopic signs of retrolental fibroplasia were noted in the form of white patches in the periphery of the infero-temporal quadrants. The infant was returned to the incubator at a flow rate of 3 liters O_2 per minute. The fundus lesions progressed. The midportion of the affected areas became detached and finally assumed the shape of a true falciform ablatio. The other three quadrants remained relatively uninvolved. When last seen the infant was reaching for objects placed in front of her. (2 figures)

Peter C. Kronfeld.

Prewitt, Leland H. **Retinal detachment possibly due to stress, parasympathotonia, and non-adaptation syndromes.** Ann. Allergy **13**:690-694, Nov.-Dec., 1955.

The author reviews the conspicuous data of medical literature on how stress can produce a variety of diseases. He then presents a patient with a history of peptic ulcer, gastritis, pylorospasm, a heart attack, and other disturbances, who had idiopathic retinal separation. He suggests that the latter was due to the effects of mental stress in a person with a high somatic sensitivity. (28 references)

Harry Horwich.

Reese, Algernon B. **Persistent hyperplastic primary vitreous.** Tr. Am. Acad. Ophth. **59**:271-286, May-June, 1955.

The lecture was printed in full in the American Journal of Ophthalmology, September, 1955.

Swan, K. C., Christensen, L., and Weisel, J. T. **Choroidal detachment in the surgical treatment of retinal separation.** A.M.A. Arch. Ophth. **55**:240-245, Feb., 1956.

Much has been written about choroidal detachment in surgery of the anterior segment, but very little in conjunction with retinal separation. The authors found in their surgery and animal experiments that choroidal detachment frequently developed if, in the presence of hypotony, the scleral curvature was altered by surgery or heat shrinkage. It was possible to induce massive choroidal edema and hemorrhage. (5 figures, 5 references) G. S. Tyner.

Volk, David. **Visual function studies in case of large aberrant vessels in the macula.** A.M.A. Arch. Ophth. **55**:119-122, Jan., 1956.

The macula was crossed by two large vessels, one arising from the inferior temporal vein and the other from the inferior temporal artery. The corrected vision of the eye was 20/20. The author believes that some unknown metabolic factors govern the distribution of the developing retinal blood vessels, normally excluding large vessels from the macula, and that the position of the macula and its fovea is predetermined and will not be altered by the position of the developing retinal blood vessels. (6 figures, 1 reference) G. S. Tyner.

Weekers, R., and Lavergne, G. **Retinal detachment followed instillation of D.F.P.** Bull. Soc. belge d'opht. **110**:273-276, June, 1955.

Retinal detachment is a rare but very serious complication following the use of D.F.P. The pathogenesis is still uncertain. It can, with probability, be ascribed to the pronounced traction, exercised by this drug not only towards the ciliary muscle and trabeculum but also backwards towards the ora serrata. Eyes, already dangerously diseased and operated on previously, and nearsighted eyes with a more vulnerable peripheral retina are apparently more inclined to this affection. D.F.P. should never be given prior to intraocular surgery, because of its vasodilatory effect. It is emphasized that D.F.P. should not be used in a stronger concentration than in a 0.01 percent solution. Two cases of retinal detachment following the use of a 0.05 percent solution of D.F.P. were observed. The first case occurred with congenital glaucoma, uncontrolled despite several operations. The fundus was difficult to see and the retinal tears could not be localized. A scleral resection proved unsuccessful. The second patient had glaucoma in an aphakic eye and myopia. D.F.P. produced a total retinal detachment. In spite of good visibility of the tears and correctly placed diathermy the retina did not become reattached. (4 references)

Alice R. Deutsch.

12

OPTIC NERVE AND CHIASM

Kirichenko, E. **Evulsion of the optic disk.** Vestnik oftal. **34**:43, March-April, 1955.

Two cases of evulsion of the optic disk are reported, one in a boy, aged seven years, and the other in a girl, aged 10 years. In both cases there was a blunt injury with a small wooden stick and with the edge of a ski respectively. The interesting feature was that in both patients there was very little trauma to the external portions of the eye, but extensive hemorrhage in the region of the optic disk.

Olga Sitchevska.

Matteucci, P., and Kluzer, G. **Symptoms of intracranial compression of the optic nerve.** Rassegna ital. d'ottal. **24**:325-337, Sept.-Oct., 1955.

The diagnosis of intracranial compression of the optic nerve presents many difficulties because of a lack of a precise symptomatology to differentiate what part of the optic pathways is involved. The ophthalmological changes in these cases are not of themselves sufficiently clearcut to determine the exact level of the path affected. Only the Foster Kennedy syndrome is sufficiently defined—that is, primary optic nerve atrophy with a central scotoma on one side, associated with contralateral stasis of the papilla and homologous anosmia. The author presented the history of 10 cases of optic nerve compression in ages from 16 to 56. Atropy was present in seven cases. There was stasis of the nervehead in all. Field studies were indefinite and difficult to measure. Anosmia was noted three times and arteriography was helpful in all cases. (4 figures, 2 tables, 33 references)

Eugene M. Blake.

Razumikhina, N. **Meningioma of the optic nerve.** Vestnik oftal. **34**:27-30, March-April, 1955.

A case of meningioma of the optic disk is reported because of its rare occurrence, its peculiar histologic structure and clinical course. The patient, aged 63 years, had lost vision in the right eye 14 years previously and proptosis of that eye became noticeable two years later. She had exophthalmos (7 mm.), no light perception, atrophy of the optic disk, and limitation of motion of the eyeball in all direc-

tions. X-ray studies showed an enlarged optic canal and changes in the floor of the orbit and other surrounding parts of the orbit. An exenteration of the orbit was performed. The macroscopic and microscopic appearance of the tumor is described in detail, which originated in the endothelial cells of the nerve sheath. (3 photomicrographs) Olga Sitchevska.

Vauthier, D., and Zanen, J. **Grooves of the disk.** Bull. Soc. belge d'opht. **110**:162-169, June, 1955.

The records of five patients with papillary grooves were presented. While the changes in the disk were the only abnormality present in the younger patients (9 and 11 years old) the older patients also had a pronounced lesion in the macula with impairment of vision. The nature of the groove had been previously explored by anatomic and pathologic studies and had been ascribed to an invagination of the pial membrane, rudimentary nerve fibers and aberrant glial tissue. The nature of the lesion of the macula still is not clear. It probably results from disturbances in the choriodal and retinal vessels with impairment of their function after a certain length of time and regressive changes in the especially vulnerable tissues at the posterior pole. A cautious prognosis concerning the future visual performance in every carrier of papillary grooves is indicated. (9 figures, 16 references)

Alice R. Deutsch.

13

NEURO-OPHTHALMOLOGY

Dubois-Poulsen, A. **Experimental reproduction of Rönne's nasal step and Bjerrum's scotoma.** Ann. d'ocul. **189**:37-52, Jan., 1956.

Bjerrum's scotoma occurred after injecting 5-percent formalin into a parasitic cyst (cysticercus) which lay on the outer aspect of the optic nerve, immediately behind the globe. Rönne's nasal step was produced in the healthy human eye by dazzling the central portion of the retina. The latter is apparently due to an unequal fall in sensation in the upper and lower retinal quadrants, whereas Bjerrum's scotoma is probably of retrobulbar origin. (4 figures, 1 reference) John C. Locke.

Gamazo Fernandez, D. Ignacio Valentin. **Ophthalmic migraine.** Arch. Soc. oftal. hispano-am. **15**:1347-1382, Dec., 1955.

This is an exhaustive monograph on the subject. The literature on the symptomatology, pathogenesis, etiology, differential diagnosis and treatment is reviewed. The author concludes that the disease is a manifestation of a disequilibrium in the diencephalon which may produce a variety of symptoms, because of its important connections with the rest of the organism, either directly or through the mediation of the glands of internal secretion and the vegetative nervous system. He prefers the Italian designation of diencephalo-endocrine hemicrania for the syndrome. Its frequency is greatest in adolescence and youth and, among the patients, nervous people and intellectuals predominate. The effect of psychic and sensory stimuli on the endocrine glands has been proven clinically although not demonstrated experimentally. The treatment should be essentially etiologic. For symptomatic relief the author obtained the best results with gynergen, administered for a period of six weeks, at first in ascending and then in descending doses. (5 figures, 62 references) Ray K. Daily.

Jayle, G. E., Camo, R., and Boyer, R. **Modifications in occipital potentials evoked by changes in illumination during intermittent light stimulation.** Ann. d'ocul. **188**:715-719, Aug., 1955.

In electroencephalographic studies, a threshold of luminance could be demonstrated beyond which photic stimulation

had no effect upon the electrical activity of the occipital cortex. The threshold varied for each individual.

John C. Locke.

Orban, Tibor. **The eyeground in multiple sclerosis.** Ophthalmologica **130**:387-396, Dec., 1955.

Thorough study of the eyeground in 50 cases of multiple sclerosis revealed the presence of retinal periphlebitis in 21 cases. The periphlebitic infiltrates may be absorbed completely or may become transformed into permanent, strikingly white sheaths. The infiltrates hardly ever erode the vessel wall. The author considers them to be a sign of a true inflammatory process. (2 figures, 2 tables, 21 references) Peter C. Kronfeld.

Paufique, L., and Etienne, R. **A little-known manifestation of multiple sclerosis: retinal periphlebitis.** Ann. d'ocul. **188**:701-707, Aug., 1955.

A 38-year-old woman with bilateral retrobulbar neuritis and diffuse sheathing of the retinal veins of both eyes developed multiple sclerosis. Retinal periphlebitis in multiple sclerosis was first described by Rucker, in 1945, who reported a series of 200 such cases. Its occurrence lends support to the vasomotor and allergic theories of this disease. In cases of venous sheathing where no other etiology can be found, one can suspect multiple sclerosis before the onset of other manifestations. (1 figure, 14 references) John C. Locke.

Payne, F. **Neuro-ophthalmology.** A.M.A. Arch. Ophth. **54**:763-788, Nov., 1955.

The year's pertinent literature is reviewed. (78 references) G. S. Tyner.

Schlaegel, T. F., Jr., and Quilala, F. V. **Hysterical amblyopia.** A.M.A. Arch. Ophth. **54**:875-884, Dec., 1955.

The incidence of hysterical amblyopia in a large group of unselected eye patients was 5.25 percent. The subject is discussed extensively. (1 figure, 9 tables, 113 references) G. S. Tyner.

Sprofkin, B. E., and Hillman, J. W. **Moebius's syndrome—congenital oculofacial paralysis.** Neurology **6**:50-54, Jan., 1956.

Moebius's syndrome is a rare congenital paresis or paralysis of the sixth and seventh cranial nerves, producing a divergent squint and facial diplegia. Two cases are presented, one associated with arthrogryposis multiplex congenita, and the other with paresis of the motor division of the left trigeminal nerve, mental deficiency, and epilepsy. The authors consider this to be evidence for the belief that a nuclear hypoplasia of variable degree and distribution is the cause, and feel that the same type of defective development is also the cause of the associated musculoskeletal anomalies. (4 figures, 16 references) Harry Horwich.

Walker, A. E., and Allègre, G. E. **Carotico-cavernous fistulas.** Ann. d'ocul. **188**:834-848, Sept., 1955.

The authors present a follow-up study of 24 cases of caroticocavernous fistula. Surgical treatment was successful in 16 cases. There were two operative deaths. In two other patients, blindness occurred postoperatively and in another, hemiplegia. (4 figures, 3 tables, 17 references) John C. Locke.

14

EYEBALL, ORBIT, SINUSES

Bogulov, M. **Combined treatment of diseases of the uveal tract with antibiotics followed by transfusions of conserved blood.** Vestnik oftal. **34**:40-42, Jan.-Feb., 1955.

The combined treatment of severely injured eyes with antibiotics and transfusions of conserved citrate blood has

been used by Bogulov since 1946. Penicillin, 12,000 units, was injected into the anterior chamber in hypopyon keratitis, repeated on the third day (if the hypopyon had not been absorbed). One intravitreal injection of penicillin, 5,000 to 6,000 units, was given in panophthalmitis. Blood transfusions were given in those cases in which the antibiotics were not too effective, the first dose being 100 cc., with an increase to 150 cc. a few more times. As a result of this combined therapy, only five eyes out of 23 had to be eviscerated. All the eyes were quite hopeless. Olga Sitchevska.

François, J., Gildemyn, H., and Rabaey, M. **Cancerous melanosis of the cornea.** Bull. Soc. belge d'opht. **110**:298-306, June, 1955.

The case history of a 55-year-old man with corneal melanosis is reported. Subconjunctival injections of acetylcholine which occasionally have proved so successful in malignant melanoma of the conjunctiva had no effect whatever. A biopsy confirmed the diagnosis of cancerous melanosis and the integrity of the corneal parenchyma. The whole lesion together with a piece of adjoining conjunctiva was excised. The epithelization of the cornea was rapid and no cloudiness of the corneal stroma occurred. The differential characteristics of cancerous and precancerous melanosis, nevocarcinoma and malignant melanoma are outlined. In precancerous melanosis, if recognized early, excision of the growth proves to be satisfactory and mutilating surgery is unnecessary and should be avoided. Precancerous melanosis starts in the basal layer of the epithelium. It should be differentiated from the microcystic nevus which is more limited and independent of the basal layer and from congenital melanosis which affects the conjunctiva as well as the subconjunctival tissue. (7 figures, 17 references)

Alice R. Deutsch.

François, J., Rabaey, M., and Evans, L. **Chronic orbital myositis.** Bull. Soc. belge d'opht. **110**:276-294, June, 1955.

Three types of orbital myositis have been described. The first group contains the congenital degenerative myopathy (syndrome of Stilling-Duane) and the acquired vascular, fatty and amyloid degenerations of the orbital muscles. The severe myositis seen in association with panophthalmitis, tenonitis or orbital cellulitis constitutes the second group. The changes observed in Graves' disease, myasthenia gravis and progressive muscular dystrophy are in the third group which also includes isolated essential disease of the orbital muscles, called chronic myositis. The three cases presented are chosen to serve as proof of the actual occurrence of this specific symptom complex and to stress the difficulty of a correct diagnosis. In all three patients the diagnosis of orbital tumor was made after careful evaluation of the signs and symptoms, and the correct diagnosis of orbital myositis was only made on the pathologic specimens after exenteration of the orbits. The extraocular muscles were affected in greater or less degrees in all three patients. They all showed granular, waxy or vacuolar degenerations of the muscle fibers themselves, edema and localized sclerosis of the interfascicular tissue and nodular infiltrations of compact lymphocytes, some plasmocytes and a few macrophages. In the clinical differential diagnosis from retrobulbar tumor, Dunnington's and Becke's sign (the dense fibrosis of the external muscles which prevent the passive rotation of the eyeball) is one of the essential items. Another important differential diagnostic point is the hypertony of the levator and retraction of the upper lid in depression of the eyeball. A relation of this muscle disease to orbital phlebitis has been described but could not be demonstrated in the cases presented. An endocrine disturbance and various toxic influences

were mentioned as possible etiological factors. A definite resemblance of the muscle changes to those seen in thyrotropic exophthalmos was noted. In spite of the potential dangers of biopsy it always should be performed before deciding on exenteration. (12 figures, 26 references) Alice R. Deutsch.

Rossi, Antonio. **Reticulosarcoma of the orbit.** Rassegna ital. d'ottal. **24**:338-351, Sept.-Oct., 1955.

A five-year-old boy developed a gradual and progressive exophthalmos on the left side leading to ulceration of the cornea. The blood picture revealed 51 percent polynucleated neutrophiles, 2 percent eosinophiles, no basophiles, 44 percent lymphocytes and 3 percent monocytes. The eye was enucleated and the orbit exenterated because of marked adherence of the neoplasm to the bony structures. The microscopic findings were a profuse and intense proliferation of tumor cells, often grouped around connective tissue tracts. The reticulo-argyrophile cells were markedly developed. The child soon developed a terminal leucemia. (10 figures, 15 references) Eugene M. Blake.

Zekman, T. N., Ladenheim, J. and Scott, R. B. **Ocular prosthetics.** A.M.A. Arch. Ophth. **54**:733-743, Nov., 1955.

After considerable experience, the authors conclude that the Mules sphere is the most satisfactory implant. Important factors in the preparation and maintenance of a prosthetic socket are described. (6 figures, 14 references) G. S. Tyner.

15

EYELIDS, LACRIMAL APPARATUS

Ashley, F. L. **Reconstruction of lacrimal apparatus.** Plast. & Reconstruct. Surg. **17**:64-72, 1956.

After briefly reviewing the literature on the reconstruction of the lacrimal apparatus, the author presents his method of placing a split-thickness skin graft, raw surface out, around a polyethylene catheter. The lumen extends from the puncta to the nasal cavity. This method is used for lacrimal structures injured or removed because of malignancy. Two representative examples from the author's series of six cases are described with photographs and drawings. He reports satisfactory results, though the longest postoperative interval at the time of publication was one year.

Alston Callahan

Braley, Alson E. **Lids, lacrimal apparatus, and conjunctiva.** A.M.A. Arch. Ophth. **55**:123-154, Jan., 1956.

This 27-page review of the literature of the lids, lacrimal apparatus and conjunctiva for 1954 is of the customary excellence and completeness, and well worth reading. (163 references)

G. S. Tyner.

Davis, Robert J. **Epidermoid carcinoma of the lacrimal sac.** A.M.A. Arch. Ophth. **55**:21-22, Jan., 1956.

To 100 cases of tumor of the lacrimal sac which have been reported, Davis adds a case of epidermoid carcinoma in a 39-year-old man. The swelling over the sac was hard, neither painful nor tender, and could not be expressed. The tumor was removed cleanly on Sept. 30, 1954, but in view of the diagnosis a complete exenteration of the ethmoid cells was performed three weeks later. Three months later a submental lymph node was found and removed, but was negative for malignancy. One year from the time of the original surgery there is no recurrence. (3 figures, 4 references) G. S. Tyner.

Flom, L., and Levitt, J. M. **Double lacrimal puncta and dacryops.** A.M.A. Arch. Ophth. **54**:760-761, Nov., 1955.

A woman, aged 61 years, presented two unusual abnormalities of the lacrimal ap-

paratus of one eye; double lacrimal puncta in the lower lid and dacryops, presumably congenital. (2 figures, 3 references) G. S. Tyner.

Gruber, Ellis. **Sarcoidosis of the lacrimal glands associated with Sjögren's syndrome.** A.M.A. Arch. Ophth. **55**:42-47, Jan., 1956.

Gruber reviews the literature, and presents the clinical pictures of sarcoidosis, Sjögren's syndrome, and Mikulicz' syndrome. It is believed that all three diseases are related and probably have a common etiologic factor (a chronic infectious process). Most investigators believe that sarcoidosis is an attenuated form of tuberculosis, being a manifestation of a high degree of immunity with a low degree of allergy. A case is presented showing generalized sarcoidosis with bilateral swelling of the lacrimal glands, together with Sjögren's syndrome. Treatment with prednisone (Metacorten), a new corticosteroid, gave relief of both conditions. (4 figures, 21 references).
G. S. Tyner.

Hughes, W. L., and Ballen, P. H. **Ectopic lacrimal gland.** A.M.A. Arch. Ophth. **55**:271-273, Feb., 1956.

This report of a corneal ectopic lacrimal gland is apparently only the second in the American literature. (4 figures, 2 references) G. S. Tyner.

Le Grand. **Lacrimal intubation, a preliminary report.** Bull. Soc. belge d'opht. **110**:157-161, June, 1955.

A modification of the lacrimal intubation of Dejean is presented. The modification includes the placement of a temporary probe and the maintenance of minute drainage. The procedure is easily performed, it preserves the physiology of the pathways and allows future renewed intubation or dacryorhinostomy if its indicated. Among the 16 patients operated on, five had unsatisfactory results. Of two patients with chronic lacrimation one developed sclerosis of the intermediary part, the second a sclerosis of the lacrimal sac. In a case of untreated dacryocystitis postoperative cellulitis caused a dense generalized fibrosis of the whole area. In two other unsuccessfully treated patients with chronic lacrimation the failure was ascribed to previous probing having caused sclerosis of the intermediary part. (26 references) Alice R. Deutsch.

Mikaelian, A. **Blaskovicz's operation in ptosis.** Vestnik oftal. **34**:20-22, Sept.-Oct., 1955.

Blaskovicz's operation was done on 25 patients (27 eyes) from 1949 to 1953. The majority of the patients were aged 17 to 23 years. The technique of the operation is described in detail. The author stresses the point that palpebro-orbital sutures should be applied, as they aid in achieving the better position of the levator and could be relied upon, in case the conjunctival sutures tear off. The excess of the levator muscle is cut off only after the sutures have been passed through the skin of the lid. Most of the patients were followed for four years. The cosmetic result was good. (6 figures)
Olga Sitchevska.

Millard, D. R., Jr. **Oriental peregrinations.** Plas. & Reconstruct. Surg. **16**:319-336, 1955.

The author reports many interesting experiences in performing plastic surgery in Korea in 1953 and 1954 and in this paper he describes a procedure which he devised to change lids from an oriental to an occidental appearance. A strip of skin 3 mms. wide is removed from the upper edge of an incision arching from the outer canthus to the beginning of the epicanthal fold. The incision splits the fold so that a small Z transposition of flaps at the epicanthus can be carried out.

This reduces the droop of the lid, flattens the epicanthal fold and exposes the caruncle. The dissection takes place anterior to the levator muscle and, since the operation is performed under local anesthesia, the levator can be observed and protected. All fat tissue is removed to let the skin of the eyelid fit against the tarsus. The author found that since the epicanthal fold on the oriental is not a web from the lack of skin but a fold of excess skin, a Z plasty is not mandatory. Mere extension of the 3 mm. strip of skin excision continued through the entire length of the epicanthal fold is effective but transposition of a small Z flap improves the appearance greatly.

Alston Callahan.

Palic-Szanto, Olga. **A case of primary lupus erythematosus confined to the lid.** Ophthalmologica **130**:186-191, Sept., 1955.

The report concerns a 48-year-old female patient whose original skin lesion consisted of rather diffuse chronic edema and deep hyperemia of one eyelid. At that time only the biopsy suggested lupus erythematosus. During a four year period of observation only the other lid of the same eye became involved. (2 figures, 17 references) Peter C. Kronfeld.

Pineiro y Carrion, Antonio. **Tumor of the lacrimal gland with atypical symptomatology.** Arch. Soc. oftal. hispano-am. **15**:1121-1130, Oct., 1955.

The author reports a case of a tumor of the left lacrimal gland, in a man 26 years old, which caused a slight exophthalmos, with papillitis, peripapillary edema and retinal folds. An anterior exploratory orbitotomy was done, and the encapsulated neoplasm was removed in toto. Complete recovery followed. The literature on mixed tumors of the lacrimal gland is reviewed. The experience with this case suggests that prior to undertaking extensive surgical intervention, it is well to do an anterior orbitotomy which may be all that becomes necessary. (3 microphotographs) Ray K. Daily.

Rizzini, Vittorio. **Endothelioma of the lid.** Gior. ital. oftal. **8**:446-453, Sept.-Oct., 1955.

A case of palpebral endothelioma is described and the literature is reviewed. (4 figures, 25 references) V. Tabone.

Sakic, D. **Contribution to the technique of the dacryocystorhinostomy.** Ophthalmologica **130**:336-339, Nov., 1955.

The lateral blade of Axenfeld's speculum has been modified so as to afford better protection for the lacrimal sac during the preparation of the opening in the nasal bones in the course of dacryocystorhinostomy operations. (2 figures) Peter C. Kronfeld.

Suarez Villafranca, Manrique R. **New techniques of blepharoplasty.** Arch. Soc. oftal. hispano-am. **15**:1219-1228, Nov., 1955.

The author points out that in plastic surgery, more than in any other field of surgery, the technique is subject to individual modifications. He reports his method of handling two cases of severe destruction of the lids of one eye, caused in one case by lupus and in the other by a military injury. In one case complete reconstruction of the lower lid and fornix was accomplished in two operations by free transplants. In the other case the lower lid was reconstructed by using a free and pedicled flap from the frontal region of the injured left orbit. The upper lid was reconstructed at a second operation by a pedicled flap based at the root of the nose taken from the right frontotemporal region. (14 figures) Ray K. Daily.

Valentin-Gamazo, Ignacio. **Treatment of lacrimal stenosis with intubation of the nasolacrimal canal.** Arch. Soc. oftal.

hispano-am. **15**:1135-1144, Oct., 1955.

The author presents a tabulated report of 15 cases of stenosis of the lacrimal sac treated with intubation of the nasolacrimal canal with a tube of acrylic. There was but one failure in this series. Compared with dacryocystorhinostomy this operation is easier, simpler, and requires no expensive instruments, and the percentage of successful results is greater after this procedure. Two points in technique refined by the author, are 1. incision of the lacrimal sac at the junction of its anterior and internal surfaces; this leaves a more satisfactory cicatrix and 2. suture of the sectional internal ligament, which, by restoring the pressure of the ligament over the apex of the sac, prevents its postoperative ectasia. (2 figures, 1 table)

Ray K. Daily.

Vincencio, A. B. **Use of nylon thread and polyethylene tubing in nasolacrimal duct stenosis.** A.M.A. Arch. Ophth. **55**:267-268, Feb., 1956.

Vincencio gives the discouraging reports of no improvement in all of 16 cases of stenosis of the nasolacrimal duct after the use of nylon thread in ten cases and polyethylene tubing in six. They were left in place for from six days to five months. The author believes that dacryocystorhinostomy is the treatment of choice for strictures of the nasolacrimal duct. (3 references) G. S. Tyner.

Wong, A. S., Fasanella, R. M., Haley, L. D., Marshall, C. L., and Krehl, W. A. **Selenium (Selsun) in the treatment of marginal blepharitis.** A.M.A. Arch. Opth. **55**:246-253, Feb., 1956.

The authors found that selenium (Selsun) sulfide ophthalmic ointment (0.5%) was relatively nontoxic when applied to the eyelid margins. They were unable to determine that the etiology of blepharitis was a specific infectious agent or that the treatment given these patients affected the flora of the eyes. The results in 76 eyes treated with selenium ophthalmic ointment did not differ significantly from those in control eyes, numbering 41, treated with ammoniated mercury ointment. Forty-nine of the entire group of 60 patients with marginal blepharitis had concomitant seborrheic dermatitis of the scalp. (7 tables, 15 references)

G. S. Tyner.

16

TUMORS

Bronstein, Melvin. **Ocular involvement in multiple myeloma.** A.M.A. Arch. Ophth. **55**:188-192, Feb., 1956.

In about one-third of the cases of fatal multiple myeloma there is infiltration of characteristic myeloma cells in the viscera or other soft tissues. A case of infiltration of the sclera, choroid, and iris is reported. A similarity between leukemic and myelomatous infiltrates is noted. (5 figures, 15 references) G. S. Tyner.

de Simone, Silvio. **Pathogenesis of ocular dermoids.** Gior. ital. oftal. **8**:383-390, Sept.-Oct., 1955.

After a brief review of the pathogenesis of ocular developmental defects, a case of dermolipoma of the outer part of the superior fornix of the right eye is described. The author suggests that dermoids are activated by trauma to aberrant germinal tissue. (4 figures, 7 references)

V. Tabone.

Riehm, G. **Orbital myeloma without systemic signs.** Klin. Monatsbl. f. Augenh. **128**:82-83, 1956.

A 67-year-old woman had sudden exophthalmus in one eye. The biopsy revealed a myeloma and in a detailed X-ray study several more osteolytic foci were found. Serum protein and sternal puncture were normal and there was no albuminuria. (11 references)

Frederick C. Blodi.

Schulze, Joachim. **Metastases in both eyes after a bilateral cancer of the breast in a man.** Klin. Monatsbl. f. Augenh. **128**:81-82, 1956.

A 66-year-old man had first one breast amputated and eight years later the other. Two years later he developed a solid detachment in both eyes. Metastesis is assumed without histologic verification. (12 references) Frederick C. Blodi.

Stokes, J. Jack. **Intraocular extension of epibulbar squamous cell carcinoma of the limbus.** Tr. Am. Acad. Ophth. **59**:143-146, March-April, 1955.

Stokes presents a case report of a squamous cell carcinoma of the limbus which during an eight-months period invaded the eyeball. (5 figures)

Theodore M. Shapira.

17

INJURIES

del Castillo, Caballero. **Skin grafts in orbital repair.** Arch. Soc. oftal. hispano-am. **15**:1118-1122, Oct., 1955.

The author describes in detail the procedures he used for the restoration of an obliterated cul-de-sac, caused by a shot at a close distance. Skin flaps from the arms were used to repair the inner surfaces of the upper and lower lids, at two sittings. Plastic tubes were held in place with three U sutures to mobilize the grafts and provide good coaptation of the graft to the wound, with excellent results. (9 figures)

Ray K. Daily.

Fleming, K. O. **Epithelial downgrowth.** Canad. M. A. J. **74**:209-211, Feb., 1956.

In nine out of 100 consecutive enucleated eyes the presence of epithelial tissue lining the anterior chamber was the primary cause of enucleation. The epithelial invasion into the anterior chamber is introduced by a flap of conjunctival or corneal epithelium turning into the eye, epithelial proliferation along the surface of a gaping wound or suture track, or by epithelial proliferation along prolapsed or incarcerated lens, vitreous or iris. A conjunctival flap is not complete insurance against epithelial downgrowth. Corneoscleral sutures may increase the incidence of epithelial downgrowth. The squamous epithelium is resistant to radiation therapy. (1 figure, 1 table, 7 references)

Irwin E. Gaynon.

Grant, W. M., and Kern, H. L. **Action of alkalies on the corneal stroma.** A.M.A. Arch. Ophth. **54**:931-939, Dec., 1955.

Irrigation with neutralizing solutions of eyes with lime burns resulted in more destruction than from lime alone. Regeneration of hydroxyl ions after irrigation with water accounts for the slowness with which the eye regains neutrality after exposure to alkalies. (1 figure, 2 tables, 7 references) G. S. Tyner.

Guttmann-Friedmann, A. **Blindness after snake-bite.** Brit. J. Ophth. **40**:57-59, Jan., 1956.

A 40-year-old man was bit by a poisonous snake on the leg and, in immediate shock, was given antivenine, cortisone and transfusions. He had severe hemorrhage in the legs and the lower part of the body. After a stormy course he recovered in 31 days. On the sixth day he had noted blurring of vision. Severe bilateral optic neuritis was found and the vision was limited to light perception and hand movements. Both discs were swollen. The vision remained unchanged and secondary optic atrophy followed. It is believed that the optic neuritis was a direct result of the hemorrhage. (5 references)

Morris Kaplan.

Junceda Avello, J., and Roiz Noriega, M. **Slit-roentgenography in the diagnosis of intraocular foreign bodies.** Arch. Soc. oftal. hispano-am. **15**:1240-1245, Nov., 1955.

The author devised an X-ray technique for the differential diagnosis of intraocular and intraorbital foreign bodies, based on the retinal perception of X rays. The patient's perception of the X rays is utilized in recognizing the posterior position of the eyeball. This is done with rays, which pass through slits of 1.5 mm. and 0.75 mm. from behind forward until the patient perceives a sense of light. Any X-ray taken in this position indicates the posterior limit of the eyeball. The technique for this procedure, which is presented as a preliminary report, is decribed in detail, and the literature on the localization of intraocular foreign bodies is briefly reviewed. (2 figures) Ray K. Daily.

Noble, J. H. and Thuss, C. J. **An unusual grease gun injury.** Plast. & Reconstruct. Surg. **16**:297-302, 1955.

The patient's left orbital region was struck by lubrication grease from a high pressure grease gun. Only first aid treatment was rendered at the time of the injury. Three months later a granulomatous process resembling a paraffinoma was present. Surgical excision was performed and the defect was closed by undermining and advancing the orbital portion of the upper lid and the remaining skin of lower lid and upper cheek. The authors contrasted this "delayed" method which they recommend for the lids because of the anastamosing blood supply to the "immediate" method of removing the injected grease from the fingers which have a terminal blood supply. Alston Callahan.

Poliak, B. **The affection of the visual organ in the explosion of the atomic bomb in Hiroshima and Nagasaki.** Vestnik oftal. **34**:38-45, Nov.-Dec., 1955.

This detailed review of the early and late injuries of the eye in persons who survived the atomic bomb explosion in Japan is based on the publications of the Japanese and American ophthalmologists on the subject. Olga Sitchevska.

Rose, H. W., Brown, D. V. L., Byrnes, V. A., and Cibis, P. A. **Human chorioretinal burns from atomic fireballs.** A.M.A. Arch. Ophth. **55**:205-210, Feb., 1956.

The permanent lesions from atomic detonation fireballs have a parallel in the chorioretinal burns described as eclipse blindness. The severity of chorioretinal damage depends on the size and temperature of the fireball, the distance, and the atmosphere. It also depends on the duration of exposure, the transparency of the ocular media, the size of the pupil, and the absorption of the pigment epithelium. The human blink reflex is inadequate protection against the atomic flash.

The history and ocular findings in six human cases of chorioretinal burns due to atomic flash are described. (10 figures, 4 references) G. S. Tyner.

18

SYSTEMIC DISEASE AND PARASITES

Appelmans, M., Michiels, J., and Missotten, L. **Cataract and other ocular complications of pulseless disease.** Bull. Soc. belge d'opht. **110**:141-150, June, 1955.

Takayasu's syndrome, also called pulseless disease, is a well known clinical entity characterized by the absence of the radial pulse, vascular changes of the retina and cataract. The case history of a 44-year-old man is reviewed in detail. Severe circulatory disturbances caused necrosis of the nasal septum, degenerative changes of the cornea, neovascularization of the iris, lens opacities and angiitis and perivascular changes in the retina. The tension in the retinal artery was decreased. The aqueous was xanthochromic, its protein content was increased, but there was no increase in cells. The ocular tension was very low, proving the seriousness of the metabolic

changes in the eye. Treatment consisted in the use of auremycin and vasodilatation. It did not change the course of the disease.

Pathologic examinations in similar cases revealed a progressive thrombosis of the subclavian and carotid arteries. The thrombi consisted of a connective tissue rich in cells and had small central openings. The intima was considerably thickened throughout, not only in the region of the thrombi, but there were no changes in the media or adventitia.

Several theories concerning the etiology of this devastating disease are reviewed, but none provide a satisfactory explanation. (1 figure, 18 references)

Alice R. Deutsch.

Branly, M. A. **Onchocerciasis.** Klin. Monatsbl. f. Augenh. **128**:1-15, 1956.

This is a review article on the ocular involvement in this filariasis. The disease was first described in Guatemala by R. Robles. It is confined to the tropics as the vector needs certain climatic conditions. Onchocerca volvulus is a nematode and is transmitted by various flies. The parasites wander from the original skin nodule (onchocercoma) to the skin or the eye.

The cornea is most frequently affected and usually shows the picture of a superficial punctate keratitis. The conjunctiva is edematous, injected and pigmented. Iritis is more frequent in Africa than in America. Microfilaria can be seen with the slitlamp in the anterior chamber or in the vitreous. The modern treatment consists of hetrazan, which is relatively harmless and can be given orally, and suramin (Bayer 205) which is highly nephrotoxic and must be given intravenously. (10 figures, 46 references)

Frederick C. Blodi.

Cogan, D. G., Kuwabara, T., Kinoshita, J., Sudarsky, D., and Ring, H. **Ocular manifestations of systemic cystinosis.** A.M.A. Arch. Ophth. **55**:36-41, Jan., 1956.

In cystinosis, or the Lignac-Fanconi syndrome, the children are afflicted with dwarfism and the accummulation of cystine crystals within many tissues of the body. There is an aminoaciduria and renal tubular dysfunction, made manifest by acidosis, hypokalemia, and impaired water reabsorption. The crystals are deposited uniformly in the cornea and with excellent illumination and magnification can be seen to be situated mainly just beneath the anterior surface. On ordinary examination they are usually missed. There are usually no ocular symptoms.

The authors report the ocular and general findings in four cases. (4 figures, 16 references)

G. S. Tyner.

Cury, D., Breakey, A. S., and Payne, B. F. **Allergic granulomatous angiitis associated with uveoscleritis and papilledema.** A.M.A. Arch. Ophth. **55**:261-266, Feb., 1956.

There has been little in the literature regarding allergic granulomatous angiitis, in fact, this may be the first case reported in ocular tissues. This disease and polyarteritis are subdivisions of the collagen disease periarteritis nodosa. This patient had a chronic history of papilledema and the eye was enucleated because of atrophy of the globe. The patient had been in ill health for six years. (4 figures, 15 references)

G. S. Tyner.

Falls, H. F., Jackson, J., Carey, J. H., Rukavina, J. G., and Block, W. D. **Ocular manifestations of hereditary primary systemic amyloidosis.** A.M.A. Arch. Ophth. **54**:660-664, Nov., 1955.

Primary systemic amyloidosis is a familial disease characterized by widespread ocular and systemic signs. The principal ocular signs are decreased vision, sheet-like vitreous opacities, peri-

arteritis, anisocoria, loss of pupillary light reflex and loss of accommodation. Diagnostic tests include biopsy for amyloidosis, and electrophoretic and ultracentrifugal findings on serum and serum lipoproteins. Six cases are reported. (5 references) G. S. Tyner.

Garcin, R., Man, H. X., and Gruner, J. **Ophthalmologic aspects of periarteritis nodosa.** Presse Med. **63**:1792-1794, Dec. 25, 1955.

This is essentially a case report of a peripheral polyneuritis, specifically a quadriplegia, in a 50-year-old man. By means of muscle biopsy the diagnosis of periarteritis nodosa was made. On initial ophthalmoscopic examination no abnormalities were seen. One month later a single yellowish exudate was seen in the left eye, but again there were no alterations in the vessels. The patient was given ACTH, but in spite of this and other therapy died one month later. The last ophthalmoscopic examination was made two days before death. At this time there were numerous exudates present, and edema of the optic nerve heads and retina. Vessels were again essentially normal, and there were only three or four punctate hemorrhages. In the periphery of the right eye there was a single area of exudative detachment; two such areas were seen in the left eye.

Histologic examination of the eyes was made and in the retina the vessels showed only a moderate dilatation. However, the choroidal vessels showed the characteristic changes of periarteritis. These are beautifully illustrated with colored photographs. The authors point out that the ophthalmoscopic changes and the anatomical changes in the retina are not specific and only help to corroborate the diagnosis. However, the alterations in the choroidal vessels are specific for periarteritis nodosa. (8 figures, 1 reference) David Shoch.

Hedges, T. R., Jr., and Scheie, H. G. **Visual field defects in exophthalmos associated with thyroid disease.** A.M.A. Arch. Ophth. **54**:885-892, Dec., 1955.

The clinical findings in six patients with exophthalmos associated with thyroid disease are reported. Each had central field defects and reduced vision. The authors believe this visual loss to be due to a mechanical disturbance of the retrobulbar portion of the optic nerve, a result of pressure in most cases. Usually vision returns spontaneously. In those patients with papilledema, however, surgical decompression of the orbit may be indicated. (2 figures, 1 table, 7 references) G. S. Tyner.

Le Grand, P., and Verlaeken, L. **Visual disturbances following loss of blood.** Bull. Soc. belge d'opht. **110**:126-137, June, 1955.

Four cases of visual disorder following hemorrhage are reported and the etiology, clinical manifestations, differential diagnosis, pathologic anatomy and pathogenesis of this symptom-complex are reviewed. It is the authors' opinion that these severe visual disturbances occur only in persons of poor general health with abnormalities in the essential constituents of the blood which made them predisposed to local acidosis and anoxemia. After every hemorrhage with a considerable reduction in arterial pressure, a large amount of epinephrine is discharged to reestablish a normal blood pressure by means of general vasoconstriction. It seems that persons of poor general health cannot compensate for the vascular stasis in connection with the vascular spasm, and nutritional disturbances occur especially in the delicate nervous tissues. If the vascular spasm continues for any length of time, lesions in the eye do not subside and the visual disturbance remains permanently. The clinical picture includes discoloration of the disk with eventual

atrophy, edema of the disk, retinal hemorrhages and exudates, narrowing of the retinal arteries, extreme lowering of the tension in the retinal artery and various restrictions of the visual fields, of which a superior hemianopsia is the most characteristic. The treatment consists of the use of vasodilators of all kinds but was not satisfactory in the authors' experience. Massive preventive blood transfusions are suggested. (4 figures, 69 references) Alice R. Deutsch.

Lukova, L. **The condition of the blind spot in normal pregnancy.** Vestnik oftal. **34**:17-21, March-April, 1955.

Campimetry was done on 50 women with normal pregnancy up to 20 weeks and on 50 women with pregnancy from 30 to 40 weeks. The age varied from 25 to 40 years. The fundus and vision were normal in all patients. In the first group abortions were indicated because of various chronic diseases. The size of the blindspot was tested before and after the delivery (or after the abortion). There was an increase in the size of the blindspot in 71 percent of the women of the first group. The vertical diameter varied from 9 to 15 degrees, the horizontal diameter was from 7 to 11 degrees in 32 percent of this group. In the second group of late pregnancy, there was an increase of the vertical diameter from 9 to 17 degrees. The size of the blindspot returned to normal in all women after delivery or interruption of the pregnancy. In some of the cases, calcium iontophoresis led to a decrease of the size of the blindspot. The author presumes that the increase of the size of the blindspot in pregnancy is caused by circulatory and metabolic changes in the retina which result in retinal edema.
Olga Sitschevska.

Marin Amat, Manuel. **Ocular manifestations in one hundred cases of tuberculous meningitis.** Arch. Soc. oftal. hispano.-am. **15**:1193-1218, Nov., 1955.

This is a detailed analysis of the ocular complications encountered in 100 cases of tuberculous meningitis. The symptoms are classified as disturbances of ocular motility, size of pupil, pupillary reflexes, and fundus changes and these are further subdivided, so that the tabulated data present a very detailed picture of the percentile occurrence of the various complications. The author points out that the ocular complications are of assistance in the diagnosis, the therapeutic indications and the prognosis of the tuberculous meningitis. It is noted that in this series the percentage of involvement of the oculomotor nerves is smaller than that of former statistics; this is attributed to the marked effectiveness of streptomycin and rimifon in arresting the exudative process. Ocular ataxia and unilateral exophthalmos are caused by irritation of the sympathetic at the pulmonary apex, and may be coincident with tuberculous meningitis, but are not caused by it. Pupillary inequalities encountered in 21 percent of the cases, are caused by compression of the third nerve at the base of the cranium, not severe enough to cause paralysis of the extraocular muscles. Abnormalities in the pupillary reactions were encountered in 55 percent of cases. Fundus changes were found in all patients; the most frequent lesion was a papilloretinal edema (in 29 percent of cases); papillitis of medium intensity was seen in 19 percent, intense papillitis in 12 percent, and postneuritic atrophy in 12 percent. (4 figures, 1 table) Ray K. Daily.

Morax, Pierre V. **Neuro-ocular involvement in the reticulo-endotheliosis of Besnier-Boeck-Schaumann.** Ann. d'ocul. **189**: 73-91, Jan., 1956.

Boeck's sarcoid in the choroid, retina and optic nerve is rare. Reported in the world literature are 10 cases of choroiditis,

eight of retinal periphlebitis, three of papillitis, three of tumor of the disc and two cases of tumor of the intracranial part of the optic nerve.

The author reports two more cases. The first occurred in a 38-year-old woman with general manifestations of sarcoidosis (proven by biopsy) in whom there was a tumor of the disc, small juxtapapillary foci of choroiditis, and small white nodules along the retinal veins; the second in a 55-year-old woman, in whom the only manifestation of the disease was a compressive lesion affecting each optic nerve, and originating in its sheath. Diagnosis was by histologic examination of the tumor taken from one side. After operation there was permanent loss of sight in this eye, but three courses of treatment with ACTH brought about complete functional recovery in the other eye, with no further recurrences during two years of observation. (5 figures, 34 references)

John C. Locke.

Rizzini, V., and Frassineti, A. **A case of fatal temporal arteritis.** Ophthalmologica **130**:178-186, Sept., 1955.

The report concerns a typical case of temporal arteritis in a 75-year-old man. The patient sought medical aid because of loss of vision in one eye which had occurred during a "grippe-like," mild febrile disease. The loss of vision proved to be due to an obstruction of one central artery. Both temporal arteries showed clinical signs of arteritis. Excision of a segment of one of them furnished material for histologic examination and seemed to relieve the patient of most of his local discomfort and occipital headache. About a month later the patient died suddenly with the clinical symptoms of bulbar paralysis. The paper does not mention an autopsy. The segment removed from the one temporal artery showed all three coats to be involved in a chronic inflammatory hypertrophic process with giant cells of the Langhans type. (5 figures, 3 references)

Peter C. Kronfeld.

Roper, Kenneth L. **Headache: ophthalmological aspects.** Northwestern Univ. Med. Sch. Quart. Bull. **30**:29-34, 1956.

It has jestingly been said that 5 percent of all headaches are ocular in origin but that 95 percent of the patients seen by ophthalmologists have this symptom as a presenting complaint. The author discusses the well known organic entities which cause headache and concludes with a very illuminating and reasonable presentation of the ill-defined entity, "eyestrain." One might summarize his views by saying that in most patients the difficulty is neither in the eye nor is it but a centrally induced discomfort, resulting from constant effort to attain "visual perfection." As evidence of this the author points out the lack of symptoms associated with high degrees of ametropia where good vision is organically unattainable. (49 references) David Shoch.

Tokareva, B. **A larva of a horsefly in the anterior chamber.** Vestnik oftal. **34**: 40-41, Sept.-Oct., 1955.

A larva (Hypoderma lineata) in the anterior chamber of a five-year-old girl is described. She spent the summer in the country, sleeping frequently on the ground of the meadow. The eye was congested, the vision was nil. The slitlamp examination showed the larva (3 by 8 mm.) in the angle of the anterior chamber. There were posterior synechia, subluxation of the lens, and vitreous in the anterior chamber. The parasite was removed through a corneal incision, 1 mm. from the limbus. The eye healed but remained blind. Olga Sitchevska.

Wagener, H. P. **The ocular manifestations of hypercalcemia.** Am. J. M. Sc. **231**: 218-230, Feb., 1956.

In this comprehensive review the dystrophic or metastatic calcification in the eye found in a varied group of local and systemic diseases and the possible process of metastatic calcification is discussed. The factor common to all these disease processes is the presence of hypercalcemia. After discussing the clinical characteristics of this syndrome, the author presents the more common etiologic agents. These include sarcoidosis, vitamin D intoxication, immobilization, primary hyperparathyroidism and renal insufficiency. (37 references) David Shoch.

19

CONGENITAL DEFORMITIES, HEREDITY

Bellavia, Marco. **The syndrome of Marfan.** Gior. ital. oftal. **8**:391-417, Sept.-Oct., 1955.

Eleven cases of Marfan's syndrome are described in detail; the six which occurred in males were definitely familial, and five in females were of indeterminate origin. The literature is exhaustively reviewed and the various theories of causation discussed. In the author's view the disease is hereditary and is usually transmitted as a dominant trait. When it occurs as an isolated phenomenon it is the result of changes in the embryo, produced by trauma; in this case it can, however, also be transmitted to descendents until it disappears by natural selection. (2 figures, 67 references) V. Tabone.

Cascio, Giuseppe. **Duplicatio supercilii.** Ophthalmologica **130**:231-243, Oct., 1955.

The extremely rare congenital anomaly of double eyebrows is described in a hydrocephalic still-born infant, unfortunately without an autopsy report. (3 figures, 7 references)

Peter C. Kronfeld.

Landolt, E. **Similar defects of color vision in three sisters with degeneration of the macula.** Arch. f. Ophth. **156**:323-327, 1955.

In a family of 14 individuals in three generations three sisters had myopia, hemeralopia and tritonopia as well as a disturbance of red-green vision. In two of the women degeneration of the fovea was obvious in ophthalmoscopic examination and visual acuity was greatly decreased whereas the third had normal foveal structure and yet a severer disturbance of color vision than either of the others. The finding shows that severest dyschromatopsia may occur with normal visual acuity and structurally normal retina and emphasizes how little we know about acquired dyschromatopsia. (1 figure, 10 references) F. H. Haessler.

Llorca, J. P., and Pinero Carrion, A. **Four cases of spontaneous subluxation of the lens, followed by acute secondary glaucoma in two sisters affected with cerebroretinal degeneration, ectopia lentis, club foot and arachnodactyly.** Arch. Soc. oftal. hispano-am. **15**:1111-1117, Oct., 1955.

The histories of two sisters with these abnormalities are reported, and the pathogenesis of the lesions is discussed. The author concludes that all these symptoms are included in the picture of status disraphicus described by Bremer and Curtius and caused by an interference in the embryonal development of the raphe. (2 figures) Ray K. Daily.

Perez Martinez, Luis F. **Congenital familial phthisis bulbi.** Arch. Soc. oftal. hispano-am. **15**:1248-1261, Nov., 1956.

The author reports a Cuban family, with 30 blind members in four generations. The blindness was due to phthisis bulbi resulting from intrauterine uveitis. The mode of transmission was sex-linked, recessive, as in hemophilia and Leber's optic atrophy. The ocular findings of the

five patients who were examined are reported in detail. The disease was always congenital, bilateral, and the children born with normal eyes did not develop phthisis bulbi subsequently. Most of the eyes were totally blind. One patient could count fingers at one foot with one eye, and two had light perception with poor projection in one eye. Two stated that as children they had enough vision to get about, but slowly and gradually lost it. The globes were atrophic, and the rectus muscles, stretched over them, gave them a quadrate appearance. Two eyes with small corneas had the appearance of a posttraumatic panophthalmitis after perforation. In the other eyes the cornea and iris were normal, and there were no malformations of the anterior segment, or colobomas of the iris or ocular adnexa. The posterior portions of the globes were small because of a folding of the sclera; the author attributes this to a uveitic atrophy of the ciliary body. The ocular tension was low. Two patients had attacks of ciliary hyperemia and lacrimation, and one had attacks of photophobia and pain which subsided on the application of cortisone. There was no history of general diseases or malformations among the affected members, except for the first patient in the first generation of the blind, who was an idiot and died in infancy. The first progenitor of this family, a woman 104 years old, and still living when this was written, did not have any blind ancestors. She was married twice and had blind children from each union, five altogether. The author believes that she had undergone a spontaneous mutation of a sex gene, and that the transmission of the disease in a recessive sex-linked manner can be arrested by the sterilization of the women in this family. (5 figures) Ray K. Daily.

Rizzoli, Emilio. **A case of duplication of the papilla.** Rassegna. ital. d'ottal. **24**: 352-362, Sept.-Oct., 1955.

On routine examination of the fundi the author discovered a unique picture in one eye in the form of a double papilla. In other respects the eyegrounds were normal and vision was 20/20. The optic papilla presented a rosy color with clear-cut edges and normal excavation. A short distance below, but clearly separated from it is another papilla about one third the size of the normal. In the major structure the number of vessels was greater than in the accessory structure and the superior arterioles of one and the inferior vessels of the other were common to the two papillae. The author reviews and describes a considerable number of similar pictures but believes that his case is unique. The condition described is definitely a congenital malformation of the optic nerve but not a scleral ectasia, as in the case of Seefelder's, nor of an unusual primative epithelial papilla of Bergmeister. The probable cause is dependent upon an abnormal suture, developed at the time of the fetal fissure. (10 figures, 11 references) Eugene M. Blake.

Rodriguez Lopez, Corviniano. **A case of cysticercus in the vitreous.** Arch. Soc. oftal. hispano-am. **15**:1167-1174, Oct., 1955.

A boy, ten years old, was found to have a cysticercus in the left eye. The diagnosis was made ophthalmoscopically, and the parasite, a cysticercus of Tinea solium, was removed surgically, through a scleral incision. The sclera was coagulated first, and when the incision was made the cyst presented itself and was easily delivered. Four months after the operation vision had improved from light perception to counting of fingers at 1 meter. (15 figures) Day K. Daily.

Rosenthal, J. W., and Kloepfer, H. W. **The spherophakia-brachymorphia syn-**

drome. A.M.A. Arch. Ophth. **55**:28-35, Jan,. 1956.

In 1939 Marchesoni described a syndrome consisting of brachydactyly, spherophakia, and glaucoma in four patients. Since then 27 additional patients have been described. This report consists of a study of five more cases which also had microphakia, ectopia lentis, index myopia, and a large *atd* angle. The syndrome is hereditary, with a recessive tendency.

The characteristics of the anomaly are discussed and the differences from Marfan's syndrome are given. Surgery for the glaucoma or the cataracts is sometimes indicated. (5 figures, 2 tables, 23 references) G. S. Tyner.

Ros Pena, Rafael. **Leber's hereditary optic atrophy.** Arch. Soc. oftal. hispanoam. **15**:1262-1270, Nov., 1956.

The author reports a case of Leber's optic atrophy in a man, 24 years old, whose mother had normal eyes. A general and neurologic examination of the patient was negative. The mother had a brother and a sister with the disease, which was less intense in the woman than in the man. The patient's sister, maternal aunt, and grandmother were deaf, but their eyes were not defective. The literature on the pathogenesis and pathology of Leber's optic atrophy is briefly reviewed. Because of a slight papillitis with blurred disc borders the author believes that this case was of a toxic-inflammatory origin, such as takes place in Gower's abiotrophy. He also points out that the presence of deafness without blindness in three members of this genealogic tree indicates that the hereditary diseases of the optic and auditory nerves are rooted in separate genes. (5 figures, 12 references) Ray K. Daily.

Weekers, R., Gougnard-Rion, C., and Gougnard, L. **A clinical study on the heredity of glaucoma.** Bull. Soc. belge d'opht. **110**:255-267, June, 1955.

The heredity of glaucoma in 162 famalies is suggested; at least one member of each family had glaucoma. Open-angle glaucoma and narrow-angle glaucoma formed two groups and the glaucoma following exfoliation of the lens capsule constitutes a third group. A survey of the members of the family of patients with open-angle glaucoma showed that an increased resistance to the outflow of aqueous was an early sign of the disease and preceded the rise in ocular tension. A survey of the relatives of patients with narrow-angle glaucoma confirmed the difficulties of an early diagnosis. The completeness or incompleteness in the closure of the chamber angle was the main factor in the rise of the ocular tension and depended on genetic factors, age and sex. However, narrow-angle or open-angle glaucoma were not characteristic for a given family, as open and narrow-angle glaucoma occurred indiscriminately. Among the 14 cases of glaucoma with exfoliation of the anterior lens capsule no family traits could be discovered. (9 figures, 2 tables, 4 references) Alice R. Deutsch.

20

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Diez, M. A., Adrogué, E., and Adrogué, E. C. **Report on the causes of blindness in the Argentine Republic.** Arch. oftal. Buenos Aires **30**:350-356, Sept., 1955.

When tabulated etiologically, visual disability resulted from infections, either exogenous or endogenous, in 38.30 percent, from congenital or hereditary conditions in 24.50 percent, from traumatism in 8.96 percent, from glaucoma in 8.01 percent, from ocular complications of systemic diseases in 1.88 percent, and from undetermined causes in 18.20 percent of the cases considered, which in

their vast majority belonged to the low-income sectors of the community and, accordingly, did not represent the whole population. This seems to explain the relatively large proportion of cases where blindness resulted from infectious diseases.

When loss of sight was considered from a topographical or anatomical standpoint the following figures were encountered for the structures afflicted: lens 22.75 percent, cornea 21.52 percent, eyeball as a whole 20.67 percent, choroid and retina 14.85 percent, optic nerve 13.45 percent, and anterior uvea 6.67 percent. No data on the total number of patients from which these percentages were taken are given. (4 graphs, 4 tables)

A. Urrets-Zavalia, Jr.

Essente, I. **Causes of amblyopia and blindness.** Gior. ital. oftal. **8**:537-541, Nov.-Dec., 1955.

The causes of amblyopia and blindness in 254 inmates of the National Institute for the Blind of Florence are listed and briefly discussed. V. Tabone.

Jeandelize, P. **The eye in the sorcery of early Egypt.** Ann. d'ocul. **189**:3-18, Jan., 1956.

The author presents a historical review of the role played by the eye in the superstitions and lore of the early Egyptians. (3 figures, 32 references)

John C. Locke.

Lowery, H. **The role of vision in the transfer of learning.** Brit. J. Physiol. Optics **13**:2-9, Jan., 1956.

While proper refractive correction of school children is important, one should not ignore the possibility that eye exercises may improve learning by transfer. By this means a study of Latin will train the memory, geometry will train reasoning processes, and woodworking will improve eye and hand coordination. For learning by transfer, the procedure must be interesting, and present some degree of utility to the student. Exercises were devised such as moving a ring along a long bent rod in the shortest possible time with and without vision. Vision was found to be especially valuable when the curves in the rod varied in three dimensions.

Paul W. Miles.

Marin Amat, M. **A tribute to Lagrange.** Arch. Soc. oftal. hispano-am. **15**:1326-1332, Dec., 1955.

This is a tribute to Lagrange by the representatives of Spanish ophthalmologists at a celebration in November, 1955, in Bordeaux, commemorating 50 years of the Lagrange sclerecto-iridectomy. The history of the antiglaucoma procedures is briefly reviewed. (5 references)

Ray K. Daily.

Pallares, J. **The work of de Delmiro de Caralt.** Arch. Soc. Oftal. hispano-am. **15**: 1145-1158, Oct., 1955.

This is a tribute to one of the prominent Spanish ophthalmologists, who lived during the first half of the 20th century. A pupil of his father and then of the prominent French ophthalmologists of his time, he was particularly interested in diseases of the fundus and errors of refraction. He never recovered from the blow of having lost his wife in her first childbirth; thereafter he abstained from surgery and devoted himself to clinical investigations. His numerous publications in this journal between 1903 and 1928, are listed, and four of these are abstracted.

Ray K. Daily.

Putchkowskaya, N. **The creative work of academician V. P. Filatov.** Vestnik oftal. **34**:3-10, May-June, 1955.

This is a tribute to Filatov on his eightieth birthday. He is still the director of the Filatov Ukranian Experimental Institute of Eye Diseases. There are three

milestones in his long scientific and practical work: 1. his round stem for plastic operations, 1917, 2. partial penetrating corneal transplantation, which he has been doing since 1922, 3. his method of tissue therapy, 1933, and 4. his glaucoma clinic, the first in the U.S.S.R. where he improved and modified many antiglaucoma operations.

The use of a special plate trephine for prevention of injury at the lens is an important contribution of Filatov to the technique of the partial penetrating keratoplasty. The use of conserved corneas from the cadaver made this operation more popular and safer. Filatov, himself, performed over 1,000, his assistants at the Institute about 3,000 keratoplasties, (plus about 4,000 keratoplasties in other eye institutes of the U.S.S.R.).

For tissue therapy the tissues of animals and plants are kept at low temperature; a biochemical reaction then takes place which produces the so-called "biogenic stimulators." These conserved tissues, when introduced into the organism of the patient, increase his regenerative power and aid his recovery in various pathologic conditions. Filatov published 374 papers. Olga Sitchevska.

Rios Sasiain, Manuel. **Problems of aeronautic ophthalmology.** Arch. Soc. oftal. hispano-am. **15**:1333-1346, Dec., 1955.

This is a detailed review of the effect of hypoxemia, reduced atmospheric pressure, speed of flight, intensity of illumination, and sunlight on the visual organs. Also described is the action of the various filtering lenses, and it is pointed out that in the closed cabins of modern planes flying goggles have lost their usefulness, and visors are now generally substituted.

Ray K. Daily.

NEWS ITEMS

Edited by Donald J. Lyle, M.D.
411 Oak Street, Cincinnati 19, Ohio

News items should reach the editor by the 12th of the month. For adequate publicity, notices of postgraduate courses and meetings should be received three months in advance.

Announcements

Course in orthoptics

Beginning in September the Department of Ophthalmology, College of Medicine, The Ohio State University, will initiate a course for orthoptic technicians. The course will combine didactic and practical instruction and will use the facilities of the University and Children's Hospitals, as well as private patients. For further information write to:

Dr. William H. Havener
Department of Ophthalmology
The Ohio State University
Columbus 10, Ohio

Orthoptic examinations

The annual examination of orthoptic technicians by the American Orthoptic Council will be conducted in August and October, 1956.

The written examination will be nonassembled and will take place on Thursday, August 23, in certain designated cities and will be proctored by assigned ophthalmologists.

The oral and practical examinations will be held on Saturday, October 13, in Chicago just preceding the meeting of the American Academy of Ophthalmology and Otolaryngology.

Application for examination will be received by the office of the Chairman of Examinations:

Dr. Frank D. Costenbader
1605 22nd St., N.W.
Washington 8, D.C.

Applications, which must be accompanied by the examination fee of $30.00, will not be accepted after July 1, 1956.

Societies

Chicago officers

At the annual business meeting of the Chicago Ophthalmological Society, Dr. Frank W. Newell was named president-elect to assure duties in 1957. Dr. Kenneth L. Roper succeeds Dr. Daniel Snydacker as president for 1956-57.

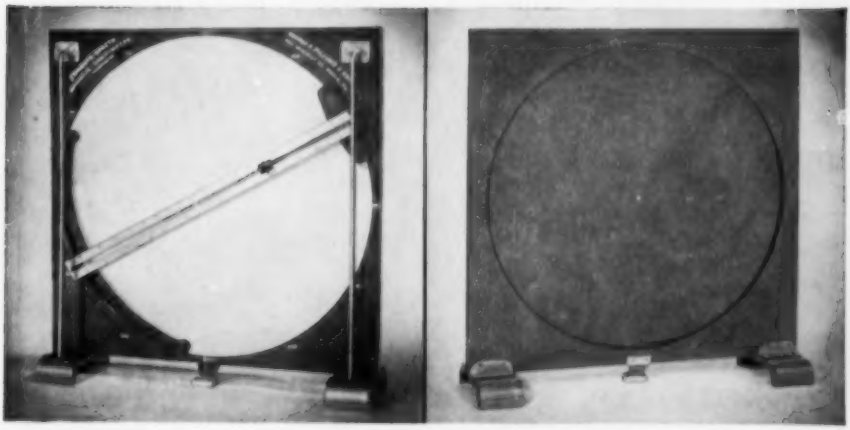
Other newly elected officers include: Dr. Orville Gordon, vice-president, succeeding Dr. Edward Albers, Champaign, Illinois; Dr. Joseph S. Haas, secretary-treasurer, succeeding Dr. Newell; and Dr. John B. Hitz, Milwaukee, Wisconsin, councillor, succeeding Dr. Edward Leiss, Appleton, Wisconsin. Dr. David Shoch was re-named corresponding secretary.

Georgia meeting

Ophthalmic speakers at the annual meeting of the Georgia Society of Ophthalmology and Otolaryngology held recently at the General Oglethorpe Hotel, Wilmington Island, Savannah, Georgia, were Dr. Irving H. Leopold, Philadelphia, who spoke on "Trends in the medical therapy of glaucoma," and "Present status of steroid therapy in ocular disease"; Dr. F. Bruce Fralick, Ann Arbor, "Minor ophthalmic surgery (with movie)," and "Periorbital lesions"; and Dr. Frank D. Costenbader, Washington, D.C., "Surgery of strabismus" and "Orthoptics."

Newly elected officers of the Georgia Society are: President Dr. W. M. Barton, Macon; vice-president, Dr. F. Phinizy Calhoun, Jr., Atlanta; secretary-treasurer, Dr. W. P. Rhyne, Albany.

The 1957 meeting will be held in April on board ship cruising from Charleston, South Carolina, to Nassau, Bahamas.



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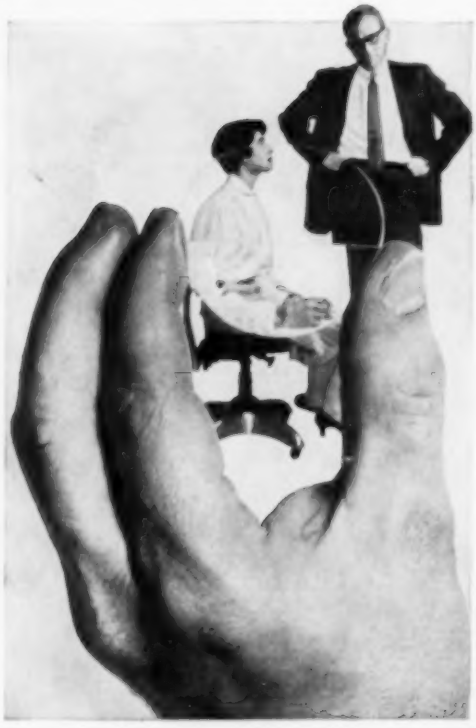

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